

Run_target-2: A Python script for automating SkyX imaging

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This is a rewrite of my original bash-based scripting system. It is more streamlined and simplified compared to the original Bash version. The side effect of this streamlining is that the script does not contain all of the oddball features found in the Bash version. On the good side, though, the nature of the Python code will make it considerably easier for the end-user to modify the script if they so desire. Although the script was intended to run on Macintosh, Raspberry Pi and Linux platforms, it also runs on Windows but does not clean up scratch files left behind from Image Links.

The syntax of the script remains essentially the same. To run the script, simply type something like:

```
./run_target-2.py m51 5x300 5x300 5x300 5x300
```

This will tell the script to image the galaxy M51 and take five images, each, of 300 second duration through the first four filters in your filter wheel. To skip a filter, insert a 0x0 in place of that filter. The script uses the same target syntax as the SkyX's find field but you must enclose the target in quotes if there is a space in the name. You can, similarly, specify a set of J2k coordinates:

```
./run_target-2 "13h 29m 52s, 47d 11m 44s" 5x300 5x300 5x300 5x300
```

As before, you can image multiple targets in a night by using semi-colons between separate commands for each target. If you need to abort a script run, you can usually do so by aborting the current operations (e.g. Take an Image, @Focus2, etc) with the SkyX GUI abort button.

The script will wait to begin a run until the sky is dark and the target is above 30 degrees. It will also stop imaging when it becomes light in the morning or the target has sunk below 35 degrees. It will refocus using @Focus2 if the temperature has changed by about a degree or an hour and a half has elapsed since the previous focus. The script will flip the mount when the target crosses the meridian, although it may get confused if you have configured your mount to flip at a custom hour angle. The script also has a limited ability to detect and pause in the case of clouds. At the conclusion of the run, the script will disconnect your cameras, slew your mount towards the appropriate pole and turn off the tracking motor. If you have a defined park position, the script will attempt to use that.

In order to accomplish this magic, your system must be: Polar & GoTo aligned, able to guide, able to Image Link & use Closed Loop Slew, able to Focus with @Focus2 (Use of @Focus3 is a simple modification for the end user.), have any necessary filter offsets

entered. Your system must also be configured to save images to a subdirectory with **no spaces** in the path name and have the OTA focal lengths noted in the camera settings.

There are two other special invocation modes.: 1.) You can duplicate images in a given image set with an extra “x” option:

```
./run_target-2.py m51 5x300x2 5x300 5x300 5x300
```

Assuming that your filters are mapped LRGB, this will execute an LLRGB. While:

```
./run_target-2.py m51 5x300x2 5x300x3 5x300 5x300x4
```

will execute an LLRRRGBBBB < dither> LLRRRGBBBB pattern. Be advised that there will be no dithers, re-focuses or flips between these “multiple” images within a set. It’s a specialized function for people with specific needs.

2.) Another special mode is to use a second (remote) imaging camera. This requires that you have mounted a second OTA & camera on the mount, which is under the control of a second version of SkyX running on a (preferably) second computer or as a second instance on the same computer.

```
./run_target-2.py m51 5x300 5x300 5x300 5x300 -r 10.0.1.7:3040 5x240  
5x240 5x240 5x240
```

will take five 5-minute exposures through the first four filters on the main system and five four-minute exposures through the second camera under the control of a copy of SkyX listening to port 3040 on a machine with the IP address of 10.0.1.7. Please ensure that the second imaging camera is configured with the appropriate temperature, autosave and binning. The images will be synchronized between the two cameras along with focusing and dithers.

In addition to being connected to the second camera & focuser (if applicable) the second instance of SkyX must also be connected to the “Telescope Simulator” in order to ensure proper automatic imaging naming and focusing exposure selection for @Focus2. If you use @Focus2 (as is the default) then you must calibrate @Focus2 to work on a star of the same magnitude as the primary (local) camera & focuser.

In order to run the script, you must have Python 3 (not Python 2) installed on your system. Python 3 is included out-of-the-box as part of Raspbian as well as the Windows 10 Subsystem for Linux. If you are running a Macintosh, you’ll probably need to install Python 3 yourself. Please download the installer here:

<https://www.python.org/ftp/python/3.6.4/python-3.6.4-macosx10.6.pkg>

or select a newer version. There is also a Windows-native (non-WSL) version.

While the older Bash version of the automation script will remain available in my file space on the Software Bisque Support site, I will no longer update or change it. I will also not create customized versions of this script, but will happily try to help you modify it yourself. Thanks to everyone who helped me write & test the original Bash version of this script. I also want to thank Anat Ruangrassamee, Colin McGill and Rick McAlister for encouraging me to learn new tricks with Python as well as everyone at Software Bisque for their continued development of SkyX and their patience with me when I pester them with questions and unsolicited advice.

Sample Run

```
./run_target-2.py m51 20x240 20x240 20x240 20x240 3x600
```

```
[21:07:21] Script Running
          NOTE: SkyX Pro Build Level: 11329
          NOTE: Checking configuration settings.
[21:07:24] Target is m51.
[21:07:28] The sky is not yet dark.
[21:07:28] waiting five minutes.
[21:13:30] The sky is not yet dark.
[21:13:30] waiting five minutes.
[21:19:31] The sky is not yet dark.
[21:19:31] waiting five minutes.
          -----
          PLAN:
                20 exposures for 240 secs. with Clear filter.
                20 exposures for 240 secs. with Red filter.
                20 exposures for 240 secs. with Green filter.
                20 exposures for 240 secs. with Blue filter.
                3 exposures for 600 secs. with Ha filter.
          -----
                83 total exposures for 350.0 total minutes.
          -----
[21:25:37] Slew to m51 starting.
          NOTE: Slew in progress.
          NOTE: Slew in progress.
[21:26:02] Arrived at m51
          NOTE: Mount currently at: 63.38 az., 65.42 alt.
[21:26:03] Conducting initial focus.
[21:27:39] @Focus2 success. Position = 5627
[21:27:39] Slew to m51 starting.
          NOTE: Slew in progress.
[21:27:53] Arrived at m51
          NOTE: Mount currently at: 63.33 az., 65.73 alt.
[21:27:54] Attempting precise positioning with CLS.
[21:28:37] CLS to m51 success (2.61 AS/pixel).
[21:28:38] Reported temperature is: 15.5
[21:28:38] Determining guider settle limit.
          NOTE: No current image available.
[21:28:38] Guider: 1s exposure
[21:28:42] Guider Image completed: LSX2_M_51_Light_00330092.fit
          NOTE: Guider image scale is 3.06 AS/Pixel.
          NOTE: Imager image scale is 1.31 AS/Pixel.
          NOTE: Image scale ratio set to: 0.43.
          NOTE: Calculated settle limit: 0.41 guider pixels.
[21:28:51] Guider: 5s exposure
[21:28:59] Guider Image completed: LSX2_M_51_Light_00330093.fit
[21:28:59] Selected guide star coordinates: 27.35, 120.26
```

NOTE: Measuring AG exposure.
 NOTE: Exposure 1 of 3 brightness: 0.93
 NOTE: Exposure 2 of 3 brightness: 0.93
 NOTE: Exposure 3 of 3 brightness: 0.93
 NOTE: Average brightness: 0.93
 NOTE: Star too bright.
 NOTE: Exposure: 2.5 Brightness: 0.36
 NOTE: Recommend AG exposure of 3.75 and a delay of 0.1.
 [21:29:32] Autoguiding started.
 [21:29:33] Guider settle limit set to 0.41 guider pixels.
 [21:29:33] Guider ON target. (0.0, 0.0) (1 of 5)
 [21:29:39] Guider off target. (-1.12, -0.26) (2 of 30)
 [21:29:45] Guider ON target. (-0.29, -0.13) (1 of 5)
 [21:29:51] Guider ON target. (-0.16, -0.04) (2 of 5)
 [21:29:57] Guider ON target. (-0.19, 0.01) (3 of 5)
 [21:30:02] Guider ON target. (-0.09, -0.01) (4 of 5)
 [21:30:08] Guider ON target. (-0.03, -0.01) (5 of 5)
 [21:30:13] Continuing.

 NOTE: Starting image SET 1 of 20.

 NOTE: IMAGE 1 OF 83.
 NOTE: Setting QSI Camera to high quality mode.
 [21:30:15] Imager: 240s exposure through Clear filter.
 [21:34:34] Image completed: SVQ-QSI_M_51_Clear_Light_00131644.fit
 NOTE: Setting QSI Camera to faster download mode.
 NOTE: Guider Tracking.
 NOTE: Statistics:
 Filter: Clear
 Image Scale: 1.305 AS/Pixel
 Image FWHM: 4.32 AS
 Average Pixel value: 13081 ADU
 Position Angle: 270 degrees
 Focuser Position: 5627
 Temperature: 15.2
 Image Altitude: 65.72
 Image Azimuth: 61.78
 Image Center (J2k): RA: 13h 29m 53.5s Dec: +47° 11' 41.3"
 Image Center (JNow): RA: 13h 30m 40.4s Dec: +47° 06' 11.3"

 NOTE: IMAGE 2 OF 83.
 NOTE: Setting QSI Camera to high quality mode.
 [21:34:51] Imager: 240s exposure through Red filter.
 [21:39:15] Image completed: SVQ-QSI_M_51_Red_Light_00131645.fit
 NOTE: Setting QSI Camera to faster download mode.
 NOTE: Guider Tracking.
 NOTE: Statistics:
 Filter: Red
 Image Scale: 1.305 AS/Pixel
 Image FWHM: 4.13 AS
 Average Pixel value: 6412 ADU
 Position Angle: 270 degrees
 Focuser Position: 5624
 Temperature: 15.0
 Image Altitude: 66.5
 Image Azimuth: 61.57
 Image Center (J2k): RA: 13h 29m 53.6s Dec: +47° 11' 41.4"
 Image Center (JNow): RA: 13h 30m 40.4s Dec: +47° 06' 11.5"

 NOTE: IMAGE 3 OF 83.
 NOTE: Setting QSI Camera to high quality mode.
 [21:39:28] Imager: 240s exposure through Green filter.
 [21:43:52] Image completed: SVQ-QSI_M_51_Green_Light_00131646.fit
 NOTE: Setting QSI Camera to faster download mode.

NOTE: Guider Tracking.
NOTE: Statistics:
Filter: Green
Image Scale: 1.305 AS/Pixel
Image FWHM: 5.56 AS
Average Pixel Value: 6055 ADU
Position Angle: 270 degrees
Focuser Position: 5627
Temperature: 14.8
Image Altitude: 67.28
Image Aziumth: 61.31
Image Center (J2k): RA: 13h 29m 53.6s Dec: +47° 11' 41.5"
Image Center (JNow): RA: 13h 30m 40.5s Dec: +47° 06' 11.5"

NOTE: IMAGE 4 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[21:44:06] Imager: 240s exposure through Blue filter.
[21:48:29] Image completed: SVQ-QSI_M_51_Blue_Light_00131647.fit
NOTE: Setting QSI Camera to faster download mode.
NOTE: Guider Tracking.
NOTE: Statistics:
Filter: Blue
Image Scale: 1.305 AS/Pixel
Image FWHM: 6.51 AS
Average Pixel Value: 4403 ADU
Position Angle: 270 degrees
Focuser Position: 5637
Temperature: 14.7
Image Altitude: 68.06
Image Aziumth: 61.0
Image Center (J2k): RA: 13h 29m 53.8s Dec: +47° 11' 40.5"
Image Center (JNow): RA: 13h 30m 40.6s Dec: +47° 06' 10.5"

NOTE: IMAGE 5 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[21:48:43] Imager: 600s exposure through Ha filter.
[21:59:06] Image completed: SVQ-QSI_M_51_Ha_Light_00131648.fit
NOTE: Setting QSI Camera to faster download mode.
NOTE: Guider Tracking.
NOTE: Statistics:
Filter: Ha
Image Scale: 1.305 AS/Pixel
Image FWHM: 5.56 AS
Average Pixel Value: 780 ADU
Position Angle: 270 degrees
Focuser Position: 5625
Temperature: 14.5
Image Altitude: 68.84
Image Aziumth: 60.65
Image Center (J2k): RA: 13h 29m 53.9s Dec: +47° 11' 39.7"
Image Center (JNow): RA: 13h 30m 40.8s Dec: +47° 06' 09.7"

NOTE: Guiding Stopped.

[21:59:24] Reported temperature is: 14.5
NOTE: Touching-up Focus.
[22:01:06] @Focus2 success. Position = 5537
[22:01:06] Slew to m51 starting.
NOTE: Slew in progress.
[22:01:20] Arrived at m51
NOTE: Mount currently at: 61.02 az., 71.43 alt.
[22:01:21] Attempting precise positioning with CLS.
[22:02:01] CLS to m51 success (2.611 AS/pixel).
[22:02:02] Reported temperature is: 14.5
[22:02:02] Calculating dither distance.

NOTE: Imager image scale is 1.31 AS/Pixel.
[22:02:15] Dithered: 1.5 AS (N), 1.8 AS (E)
[22:02:24] Guider: 5s exposure
[22:02:32] Guider Image completed: LSX2_M_51_Light_00330500.fit
[22:02:32] Selected guide star coordinates: 218.27, 384.14
NOTE: Measuring AG exposure.
NOTE: Exposure 1 of 3 brightness: 0.66
NOTE: Exposure 2 of 3 brightness: 0.66
NOTE: Exposure 3 of 3 brightness: 0.66
NOTE: Average brightness: 0.66
NOTE: No guider exposure change recommended.
[22:03:00] Autoguiding started.
[22:03:01] Guider settle limit set to 0.41 guider pixels.
[22:03:02] Guider ON target. (-0.11, -0.04) (1 of 5)
[22:03:09] Guider off target. (1.28, -0.52) (2 of 30)
[22:03:16] Guider off target. (0.79, -0.07) (3 of 30)
[22:03:23] Guider off target. (0.61, -0.37) (4 of 30)
[22:03:30] Guider ON target. (0.1, 0.08) (1 of 5)
[22:03:37] Guider ON target. (0.01, 0.01) (2 of 5)
[22:03:44] Guider ON target. (0.11, -0.05) (3 of 5)
[22:03:50] Guider ON target. (0.37, 0.0) (4 of 5)
[22:03:57] Guider ON target. (0.28, 0.09) (5 of 5)
[22:04:03] Continuing.

NOTE: Starting image SET 2 of 20.

NOTE: IMAGE 6 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[22:04:05] Imager: 240s exposure through Clear filter.
[22:08:24] Image completed: SVQ-QSI_M_51_Clear_Light_00131688.fit
NOTE: Setting QSI Camera to faster download mode.
NOTE: Guider Tracking.
NOTE: Statistics:
Filter: Clear
Image Scale: 1.305 AS/Pixel
Image FWHM: 4.63 AS
Average Pixel Value: 12289 ADU
Position Angle: 270 degrees
Focuser Position: 5537
Temperature: 14.4
Image Altitude: 71.41
Image Aziumth: 58.98
Image Center (J2k): RA: 13h 29m 53.8s Dec: +47° 11' 42.6"
Image Center (JNow): RA: 13h 30m 40.6s Dec: +47° 06' 12.6"

NOTE: IMAGE 7 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[22:08:39] Imager: 240s exposure through Red filter.
[22:13:02] Image completed: SVQ-QSI_M_51_Red_Light_00131689.fit
NOTE: Setting QSI Camera to faster download mode.
NOTE: Guider Tracking.
NOTE: Statistics:
Filter: Red
Image Scale: 1.305 AS/Pixel
Image FWHM: 3.05 AS
Average Pixel Value: 5986 ADU
Position Angle: 270 degrees
Focuser Position: 5534
Temperature: 14.3
Image Altitude: 72.15
Image Aziumth: 58.34
Image Center (J2k): RA: 13h 29m 53.9s Dec: +47° 11' 42.4"
Image Center (JNow): RA: 13h 30m 40.8s Dec: +47° 06' 12.4"

NOTE: IMAGE 8 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[22:13:15] Imager: 240s exposure through Green filter.
[22:17:39] Image completed: SVQ-QSI_M_51_Green_Light_00131690.fit
NOTE: Setting QSI Camera to faster download mode.
NOTE: Guider Tracking.
NOTE: Statistics:
Filter: Green
Image Scale: 1.305 AS/Pixel
Image FWHM: 4.03 AS
Average Pixel Value: 5814 ADU
Position Angle: 270 degrees
Focuser Position: 5537
Temperature: 14.1
Image Altitude: 72.91
Image Aziumth: 57.57
Image Center (J2k): RA: 13h 29m 54.1s Dec: +47° 11' 41.1"
Image Center (JNow): RA: 13h 30m 40.9s Dec: +47° 06' 11.1"

NOTE: IMAGE 9 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[22:17:52] Imager: 240s exposure through Blue filter.
[22:22:14] Image completed: SVQ-QSI_M_51_Blue_Light_00131691.fit
NOTE: Setting QSI Camera to faster download mode.
NOTE: Guider Tracking.
NOTE: Statistics:
Filter: Blue
Image Scale: 1.306 AS/Pixel
Image FWHM: 5.03 AS
Average Pixel Value: 4227 ADU
Position Angle: 270 degrees
Focuser Position: 5547
Temperature: 14.0
Image Altitude: 73.65
Image Aziumth: 56.71
Image Center (J2k): RA: 13h 29m 54.2s Dec: +47° 11' 38.7"
Image Center (JNow): RA: 13h 30m 41.1s Dec: +47° 06' 08.7"

NOTE: IMAGE 10 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[22:22:28] Imager: 600s exposure through Ha filter.
[22:32:51] Image completed: SVQ-QSI_M_51_Ha_Light_00131692.fit
NOTE: Setting QSI Camera to faster download mode.
NOTE: Guider Tracking.
NOTE: Statistics:
Filter: Ha
Image Scale: 1.305 AS/Pixel
Image FWHM: 3.78 AS
Average Pixel Value: 746 ADU
Position Angle: 270 degrees
Focuser Position: 5535
Temperature: 13.6
Image Altitude: 74.39
Image Aziumth: 55.73
Image Center (J2k): RA: 13h 29m 54.2s Dec: +47° 11' 39.2"
Image Center (JNow): RA: 13h 30m 41.1s Dec: +47° 06' 09.3"

NOTE: Guiding Stopped.

[22:33:07] Reported temperature is: 13.6
NOTE: Touching-up Focus.
[22:34:52] @Focus2 success. Position = 5477
[22:34:52] Slew to m51 starting.
NOTE: Slew in progress.
[22:35:06] Arrived at m51

NOTE: Mount currently at: 54.05 az., 76.96 alt.
[22:35:07] Attempting precise positioning with CLS.
[22:35:47] CLS to m51 success (2.611 AS/pixel).
[22:35:48] Reported temperature is: 13.6
[22:35:48] Calculating dither distance.
NOTE: Imager image scale is 1.31 AS/Pixel.
[22:36:01] Dithered: 3.8 AS (N), 11.5 AS (E)
[22:36:10] Guider: 5s exposure
[22:36:18] Guider Image completed: LSX2_M_51_Light_00330829.fit
[22:36:18] Selected guide star coordinates: 30.53, 122.87
NOTE: Measuring AG exposure.
NOTE: Exposure 1 of 3 brightness: 0.84
NOTE: Exposure 2 of 3 brightness: 0.84
NOTE: Exposure 3 of 3 brightness: 0.84
NOTE: Average brightness: 0.84
NOTE: Star too bright.
NOTE: Recommend AG exposure of 4.2 and a delay of 0.8.
[22:36:46] Autoguiding started.
[22:36:47] Guider settle limit set to 0.41 guider pixels.
[22:36:48] Guider ON target. (0.13, -0.05) (1 of 5)
[22:36:55] Guider off target. (-0.48, -0.26) (2 of 30)
[22:37:02] Guider ON target. (0.06, -0.24) (1 of 5)
[22:37:09] Guider ON target. (-0.18, 0.09) (2 of 5)
[22:37:16] Guider ON target. (-0.38, 0.12) (3 of 5)
[22:37:23] Guider ON target. (-0.3, 0.17) (4 of 5)
[22:37:30] Guider off target. (-0.51, 0.22) (7 of 30)
[22:37:37] Guider ON target. (0.04, -0.07) (1 of 5)
[22:37:44] Guider ON target. (0.1, 0.06) (2 of 5)
[22:37:50] Guider ON target. (0.14, 0.05) (3 of 5)
[22:37:57] Guider ON target. (0.03, -0.02) (4 of 5)
[22:38:05] Guider ON target. (0.05, 0.12) (5 of 5)
[22:38:11] Continuing.

NOTE: Starting image SET 3 of 20.

NOTE: IMAGE 11 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[22:38:13] Imager: 240s exposure through Clear filter.
[22:42:31] Image completed: SVQ-QSI_M_51_Clear_Light_00131732.fit
NOTE: Setting QSI Camera to faster download mode.
NOTE: Guider Tracking.
NOTE: Statistics:
Filter: Clear
Image Scale: 1.306 AS/Pixel
Image FWHM: 3.96 AS
Average Pixel Value: 11900 ADU
Position Angle: 270 degrees
Focuser Position: 5477
Temperature: 13.4
Image Altitude: 76.83
Image Aziumth: 51.21
Image Center (J2k): RA: 13h 29m 54.5s Dec: +47° 11' 45.6"
Image Center (JNow): RA: 13h 30m 41.4s Dec: +47° 06' 15.6"

NOTE: IMAGE 12 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[22:42:47] Imager: 240s exposure through Red filter.
[22:47:10] Image completed: SVQ-QSI_M_51_Red_Light_00131733.fit
NOTE: Setting QSI Camera to faster download mode.
NOTE: Guider Tracking.
NOTE: Statistics:
Filter: Red
Image Scale: 1.306 AS/Pixel
Image FWHM: 3.46 AS

Average Pixel Value: 5908 ADU
Position Angle: 270 degrees
Focuser Position: 5474
Temperature: 13.3
Image Altitude: 77.51
Image Aziumth: 49.47
Image Center (J2k): RA: 13h 29m 54.6s Dec: +47° 11' 45.5"
Image Center (JNow): RA: 13h 30m 41.5s Dec: +47° 06' 15.6"

NOTE: IMAGE 13 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[22:47:25] Imager: 240s exposure through Green filter.
[22:51:48] Image completed: SVQ-QSI_M_51_Green_Light_00131734.fit

NOTE: Setting QSI Camera to faster download mode.

NOTE: Guider Tracking.

NOTE: Statistics:

Filter: Green
Image Scale: 1.306 AS/Pixel
Image FWHM: 3.84 AS
Average Pixel Value: 5687 ADU
Position Angle: 270 degrees
Focuser Position: 5477
Temperature: 13.2
Image Altitude: 78.18
Image Aziumth: 47.45
Image Center (J2k): RA: 13h 29m 54.6s Dec: +47° 11' 45.6"
Image Center (JNow): RA: 13h 30m 41.5s Dec: +47° 06' 15.7"

NOTE: IMAGE 14 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[22:52:01] Imager: 240s exposure through Blue filter.
[22:56:24] Image completed: SVQ-QSI_M_51_Blue_Light_00131735.fit

NOTE: Setting QSI Camera to faster download mode.

NOTE: Guider Tracking.

NOTE: Statistics:

Filter: Blue
Image Scale: 1.306 AS/Pixel
Image FWHM: 4.59 AS
Average Pixel Value: 4106 ADU
Position Angle: 270 degrees
Focuser Position: 5487
Temperature: 13.0
Image Altitude: 78.82
Image Aziumth: 45.19
Image Center (J2k): RA: 13h 29m 54.7s Dec: +47° 11' 45.6"
Image Center (JNow): RA: 13h 30m 41.6s Dec: +47° 06' 15.7"

NOTE: IMAGE 15 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[22:56:37] Imager: 600s exposure through Ha filter.
[23:06:59] Image completed: SVQ-QSI_M_51_Ha_Light_00131736.fit

NOTE: Setting QSI Camera to faster download mode.

NOTE: Guider Tracking.

NOTE: Statistics:

Filter: Ha
Image Scale: 1.306 AS/Pixel
Image FWHM: 4.21 AS
Average Pixel Value: 746 ADU
Position Angle: 270 degrees
Focuser Position: 5475
Temperature: 12.7
Image Altitude: 79.44
Image Aziumth: 42.61
Image Center (J2k): RA: 13h 29m 54.8s Dec: +47° 11' 45.9"

Image Center (JNow): RA: 13h 30m 41.6s Dec: +47° 06' 15.9"

NOTE: Guiding Stopped.

[23:07:17] Reported temperature is: 12.7

NOTE: Touching-up Focus.

NOTE: Target is near the meridian.

NOTE: OTA is west of the meridian pointing east.

NOTE: Slewing towards the east, away from meridian.

[23:09:07] @Focus2 success. Position = 5432

[23:09:07] Slew to m51 starting.

NOTE: Slew in progress.

[23:09:21] Arrived at m51

NOTE: Mount currently at: 34.23 az., 81.67 alt.

[23:09:22] Attempting precise positioning with CLS.

[23:10:00] CLS to m51 success (2.611 AS/pixel).

[23:10:01] Reported temperature is: 12.7

[23:10:01] Calculating dither distance.

NOTE: Imager image scale is 1.31 AS/Pixel.

[23:10:15] Dithered: 7.0 AS (N), 5.9 AS (E)

[23:10:24] Guider: 5s exposure

[23:10:32] Guider Image completed: LSX2_M_51_Light_00331159.fit

[23:10:33] Selected guide star coordinates: 31.22, 121.86

NOTE: Measuring AG exposure.

NOTE: Exposure 1 of 3 brightness: 0.52

NOTE: Exposure 2 of 3 brightness: 0.52

NOTE: Exposure 3 of 3 brightness: 0.52

NOTE: Average brightness: 0.52

NOTE: No guider exposure change recommended.

[23:11:00] Autoguiding started.

[23:11:01] Guider settle limit set to 0.41 guider pixels.

[23:11:02] Guider off target. (-0.48, -0.03) (1 of 30)

[23:11:09] Guider off target. (-0.11, -0.64) (2 of 30)

[23:11:16] Guider ON target. (-0.09, -0.36) (1 of 5)

[23:11:23] Guider ON target. (0.32, -0.11) (2 of 5)

[23:11:30] Guider ON target. (0.25, 0.16) (3 of 5)

[23:11:37] Guider ON target. (-0.34, -0.18) (4 of 5)

[23:11:43] Guider ON target. (-0.08, 0.27) (5 of 5)

[23:11:49] Continuing.

NOTE: Starting image SET 4 of 20.

NOTE: IMAGE 16 OF 83.

NOTE: Setting QSI Camera to high quality mode.

[23:11:51] Imager: 240s exposure through Clear filter.

[23:16:10] Image completed: SVQ-QSI_M_51_Clear_Light_00131776.fit

NOTE: Setting QSI Camera to faster download mode.

NOTE: Guider Tracking.

NOTE: Statistics:

Filter:	Clear
Image Scale:	1.306 AS/Pixel
Image FWHM:	3.8 AS
Average Pixel Value:	11439 ADU
Position Angle:	270 degrees
Focuser Position:	5432
Temperature:	12.4
Image Altitude:	81.22
Image Aziumth:	31.25
Image Center (J2k):	RA: 13h 29m 54.3s Dec: +47° 11' 48.1"
Image Center (JNow):	RA: 13h 30m 41.1s Dec: +47° 06' 18.1"

NOTE: IMAGE 17 OF 83.

NOTE: Setting QSI Camera to high quality mode.

[23:16:24] Imager: 240s exposure through Red filter.

^[[B[23:20:46] Image completed: SVQ-QSI_M_51_Red_Light_00131777.fit

NOTE: Setting QSI Camera to faster download mode.
NOTE: Guider Tracking.
NOTE: Statistics:
Filter: Red
Image Scale: 1.306 AS/Pixel
Image FWHM: 3.37 AS
Average Pixel Value: 5647 ADU
Position Angle: 270 degrees
Focuser Position: 5429
Temperature: 12.3
Image Altitude: 81.64
Image Aziumth: 26.94
Image Center (J2k): RA: 13h 29m 54.3s Dec: +47° 11' 47.9"
Image Center (JNow): RA: 13h 30m 41.2s Dec: +47° 06' 18.0"

NOTE: IMAGE 18 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[23:21:00] Imager: 240s exposure through Green filter.
[23:25:23] Image completed: SVQ-QSI_M_51_Green_Light_00131778.fit
NOTE: Setting QSI Camera to faster download mode.
NOTE: Guider Tracking.
NOTE: Statistics:
Filter: Green
Image Scale: 1.306 AS/Pixel
Image FWHM: 3.63 AS
Average Pixel Value: 5494 ADU
Position Angle: 270 degrees
Focuser Position: 5432
Temperature: 12.1
Image Altitude: 82.01
Image Aziumth: 21.99
Image Center (J2k): RA: 13h 29m 54.3s Dec: +47° 11' 48.4"
Image Center (JNow): RA: 13h 30m 41.2s Dec: +47° 06' 18.4"

NOTE: IMAGE 19 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[23:25:37] Imager: 240s exposure through Blue filter.
[23:30:00] Image completed: SVQ-QSI_M_51_Blue_Light_00131779.fit
NOTE: Setting QSI Camera to faster download mode.
NOTE: Guider Tracking.
NOTE: Statistics:
Filter: Blue
Image Scale: 1.306 AS/Pixel
Image FWHM: 4.37 AS
Average Pixel Value: 3964 ADU
Position Angle: 270 degrees
Focuser Position: 5442
Temperature: 11.9
Image Altitude: 82.3
Image Aziumth: 16.68
Image Center (J2k): RA: 13h 29m 54.4s Dec: +47° 11' 48.3"
Image Center (JNow): RA: 13h 30m 41.3s Dec: +47° 06' 18.3"
NOTE: Guiding Stopped.

[23:30:17] Reported temperature is: 12.0
[23:30:17] Calculating dither distance.
NOTE: Imager image scale is 1.31 AS/Pixel.
[23:30:31] Dithered: 5.7 AS (S), 1.7 AS (E)
[23:30:40] Guider: 5s exposure
[23:30:47] Guider Image completed: LSX2_M_51_Light_00331370.fit
[23:30:48] Selected guide star coordinates: 30.32, 122.28
NOTE: Measuring AG exposure.
NOTE: Exposure 1 of 3 brightness: 0.66
NOTE: Exposure 2 of 3 brightness: 0.66

NOTE: Exposure 3 of 3 brightness: 0.66
 NOTE: Average brightness: 0.66
 NOTE: No guider exposure change recommended.
 [23:31:15] Autoguiding started.
 [23:31:16] Guider settle limit set to 0.41 guider pixels.
 [23:31:17] Guider off target. (-0.67, 0.23) (1 of 30)
 [23:31:24] Guider off target. (-1.5, -0.33) (2 of 30)
 [23:31:31] Guider ON target. (0.08, -0.32) (1 of 5)
 [23:31:38] Guider ON target. (0.17, -0.2) (2 of 5)
 [23:31:46] Guider ON target. (0.05, -0.17) (3 of 5)
 [23:31:52] Guider ON target. (-0.17, 0.12) (4 of 5)
 [23:31:59] Guider ON target. (-0.19, 0.03) (5 of 5)
 [23:32:05] Continuing.

 NOTE: Starting image SET 5 of 20.

 NOTE: IMAGE 20 OF 83.
 NOTE: Setting QSI Camera to high quality mode.
 [23:32:07] Imager: 240s exposure through Clear filter.
 [23:36:32] Image completed: SVQ-QSI_M_51_Clear_Light_00131780.fit
 NOTE: Setting QSI Camera to faster download mode.
 NOTE: Guider Tracking.
 NOTE: Statistics:
 Filter: Clear
 Image Scale: 1.306 AS/Pixel
 Image FWHM: 4.75 AS
 Average Pixel Value: 11408 ADU
 Position Angle: 270 degrees
 Focuser Position: 5432
 Temperature: 11.8
 Image Altitude: 82.58
 Image Aziumth: 8.5
 Image Center (J2k): RA: 13h 29m 54.4s Dec: +47° 11' 46.1"
 Image Center (JNow): RA: 13h 30m 41.2s Dec: +47° 06' 16.1"

 NOTE: IMAGE 21 OF 83.
 NOTE: Setting QSI Camera to high quality mode.
 [23:36:46] Imager: 240s exposure through Red filter.
 [23:41:10] Image completed: SVQ-QSI_M_51_Red_Light_00131781.fit
 NOTE: Setting QSI Camera to faster download mode.
 NOTE: Guider Tracking.
 NOTE: Statistics:
 Filter: Red
 Image Scale: 1.306 AS/Pixel
 Image FWHM: 4.28 AS
 Average Pixel Value: 5640 ADU
 Position Angle: 270 degrees
 Focuser Position: 5429
 Temperature: 11.7
 Image Altitude: 82.66
 Image Aziumth: 2.33
 Image Center (J2k): RA: 13h 29m 54.4s Dec: +47° 11' 45.7"
 Image Center (JNow): RA: 13h 30m 41.3s Dec: +47° 06' 15.8"

 NOTE: IMAGE 22 OF 83.
 NOTE: Setting QSI Camera to high quality mode.
 [23:41:23] Imager: 240s exposure through Green filter.
 [23:45:46] Image completed: SVQ-QSI_M_51_Green_Light_00131782.fit
 NOTE: Setting QSI Camera to faster download mode.
 NOTE: Guider Tracking.
 NOTE: Statistics:
 Filter: Green
 Image Scale: 1.306 AS/Pixel
 Image FWHM: 4.76 AS

```

Average Pixel Value: 5468 ADU
Position Angle: 270 degrees
Focuser Position: 5432
Temperature: 11.6
Image Altitude: 82.65
Image Aziumth: 356.22
Image Center (J2k): RA: 13h 29m 54.4s Dec: +47° 11' 45.9"
Image Center (JNow): RA: 13h 30m 41.3s Dec: +47° 06' 15.9"
-----
NOTE: IMAGE 23 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[23:46:00] Imager: 240s exposure through Blue filter.
[23:50:22] Image completed: SVQ-QSI_M_51_Blue_Light_00131783.fit
NOTE: Setting QSI Camera to faster download mode.
NOTE: Guider Tracking.
NOTE: Statistics:
Filter: Blue
Image Scale: 1.306 AS/Pixel
Image FWHM: 5.51 AS
Average Pixel Value: 3957 ADU
Position Angle: 270 degrees
Focuser Position: 5442
Temperature: 11.6
Image Altitude: 82.54
Image Aziumth: 350.09
Image Center (J2k): RA: 13h 29m 54.5s Dec: +47° 11' 45.9"
Image Center (JNow): RA: 13h 30m 41.3s Dec: +47° 06' 16.0"
NOTE: Guiding Stopped.
-----
[23:50:39] Reported temperature is: 11.6
[23:50:40] Target has crossed the meridian.
[23:50:41] Slew to m51 starting.
NOTE: Slew in progress.
NOTE: Slew in progress.
NOTE: Slew in progress.
[23:51:16] Arrived at m51
NOTE: Mount currently at: 341.88 az., 81.59 alt.
NOTE: Target is near the meridian.
NOTE: OTA is east of the meridian, pointing west.
NOTE: Slewng towards the west, away from meridian.
[23:53:06] @Focus2 success. Position = 5386
[23:53:06] Slew to m51 starting.
NOTE: Slew in progress.
[23:53:20] Arrived at m51
NOTE: Mount currently at: 339.67 az., 81.46 alt.
[23:53:21] Attempting precise positioning with CLS.
[23:54:01] CLS to m51 success (2.612 AS/pixel).
[23:54:02] Reported temperature is: 11.6
[23:54:07] Guider: 5s exposure
[23:54:15] Guider Image completed: LSX2_M_51_Light_00331583.fit
[23:54:15] Selected guide star coordinates: 530.05, 455.94
NOTE: Measuring AG exposure.
NOTE: Exposure 1 of 3 brightness: 0.99
NOTE: Exposure 2 of 3 brightness: 0.99
NOTE: Exposure 3 of 3 brightness: 0.99
NOTE: Average brightness: 0.99
NOTE: Star too bright.
NOTE: Exposure: 2.5 Brightness: 0.99
NOTE: Exposure: 1.25 Brightness: 0.63
NOTE: Recommend AG exposure of 1.4 and a delay of 3.6.
[23:54:51] Autoguiding started.
[23:54:52] Guider settle limit set to 0.41 guider pixels.
[23:54:53] Guider ON target. (0.14, 0.08) (1 of 5)
[23:55:00] Guider off target. (1.81, 0.45) (2 of 30)

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[23:55:07] Guider off target. (0.6, 0.25) (3 of 30)
 [23:55:14] Guider ON target. (0.14, 0.1) (1 of 5)
 [23:55:21] Guider ON target. (0.22, -0.07) (2 of 5)
 [23:55:28] Guider ON target. (0.38, 0.22) (3 of 5)
 [23:55:35] Guider ON target. (-0.38, 0.4) (4 of 5)
 [23:55:42] Guider off target. (0.84, -0.22) (8 of 30)
 [23:55:49] Guider off target. (0.77, 0.09) (9 of 30)
 [23:55:56] Guider ON target. (0.14, -0.07) (1 of 5)
 [23:56:03] Guider ON target. (0.02, 0.01) (2 of 5)
 [23:56:10] Guider ON target. (-0.11, 0.15) (3 of 5)
 [23:56:17] Guider off target. (-0.42, 0.3) (13 of 30)
 [23:56:24] Guider off target. (-0.74, 0.15) (14 of 30)
 [23:56:31] Guider off target. (-0.56, 0.37) (15 of 30)
 [23:56:38] Guider ON target. (-0.23, -0.2) (1 of 5)
 [23:56:45] Guider off target. (0.86, 0.04) (17 of 30)
 [23:56:52] Guider ON target. (0.27, 0.08) (1 of 5)
 [23:56:59] Guider ON target. (-0.18, 0.35) (2 of 5)
 [23:57:06] Guider off target. (-1.49, -0.01) (20 of 30)
 [23:57:13] Guider ON target. (-0.05, -0.24) (1 of 5)
 [23:57:20] Guider off target. (0.42, -0.09) (22 of 30)
 [23:57:27] Guider ON target. (0.11, 0.04) (1 of 5)
 [23:57:34] Guider off target. (0.61, 0.23) (24 of 30)
 [23:57:40] Guider ON target. (-0.36, -0.04) (1 of 5)
 [23:57:47] Guider ON target. (0.03, -0.06) (2 of 5)
 [23:57:54] Guider ON target. (0.19, -0.22) (3 of 5)
 [23:58:01] Guider off target. (0.48, -0.06) (28 of 30)
 [23:58:08] Guider ON target. (0.21, -0.09) (1 of 5)
 [23:58:15] Guider ON target. (0.35, -0.04) (2 of 5)
 NOTE: Guider not settled but does not appear to be lost.
 [23:58:21] Continuing.

NOTE: Starting image SET 6 of 20.

NOTE: IMAGE 24 OF 83.
 NOTE: Setting QSI Camera to high quality mode.
 [23:58:23] Imager: 240s exposure through Clear filter.
 [00:02:42] Image completed: SVQ-QSI_M_51_Clear_Light_00131823.fit
 NOTE: Setting QSI Camera to faster download mode.
 NOTE: Guider Tracking.
 NOTE: Statistics:
 Filter: Clear
 Image Scale: 1.306 AS/Pixel
 Image FWHM: 3.97 AS
 Average Pixel value: 11279 ADU
 Position Angle: 90 degrees
 Focuser Position: 5386
 Temperature: 11.6
 Image Altitude: 81.84
 Image Aziumth: 335.44
 Image Center (J2k): RA: 13h 29m 52.0s Dec: +47° 11' 44.3"
 Image Center (JNow): RA: 13h 30m 38.8s Dec: +47° 06' 14.3"

NOTE: IMAGE 25 OF 83.
 NOTE: Setting QSI Camera to high quality mode.
 [00:02:58] Imager: 240s exposure through Red filter.
 [00:07:21] Image completed: SVQ-QSI_M_51_Red_Light_00131824.fit
 NOTE: Setting QSI Camera to faster download mode.
 NOTE: Guider Tracking.
 NOTE: Statistics:
 Filter: Red
 Image Scale: 1.306 AS/Pixel
 Image FWHM: 3.4 AS
 Average Pixel value: 5583 ADU
 Position Angle: 90 degrees

```

        Focuser Position:      5383
        Temperature:          11.6
        Image Altitude:        81.44
        Image Aziumth:         330.81
        Image Center (J2k):    RA: 13h 29m 51.9s  Dec: +47° 11' 43.0"
        Image Center (JNow):   RA: 13h 30m 38.8s  Dec: +47° 06' 13.0"
        -----
NOTE: IMAGE 26 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[00:07:35] Imager: 240s exposure through Green filter.
[00:11:58] Image completed: SVQ-QSI_M_51_Green_Light_00131825.fit
NOTE: Setting QSI Camera to faster download mode.
NOTE: Guider Tracking.
NOTE: Statistics:
        Filter:                Green
        Image Scale:            1.306 AS/Pixel
        Image FWHM:            4.33 AS
        Average Pixel Value:    5381 ADU
        Position Angle:        90 degrees
        Focuser Position:      5386
        Temperature:          11.6
        Image Altitude:        80.98
        Image Aziumth:         326.59
        Image Center (J2k):    RA: 13h 29m 51.9s  Dec: +47° 11' 42.9"
        Image Center (JNow):   RA: 13h 30m 38.8s  Dec: +47° 06' 12.9"
        -----
NOTE: IMAGE 27 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[00:12:13] Imager: 240s exposure through Blue filter.
[00:16:35] Image completed: SVQ-QSI_M_51_Blue_Light_00131826.fit
NOTE: Setting QSI Camera to faster download mode.
NOTE: Guider Tracking.
NOTE: Statistics:
        Filter:                Blue
        Image Scale:            1.306 AS/Pixel
        Image FWHM:            4.45 AS
        Average Pixel Value:    3839 ADU
        Position Angle:        90 degrees
        Focuser Position:      5396
        Temperature:          11.4
        Image Altitude:        80.47
        Image Aziumth:         322.91
        Image Center (J2k):    RA: 13h 29m 51.9s  Dec: +47° 11' 44.0"
        Image Center (JNow):   RA: 13h 30m 38.7s  Dec: +47° 06' 14.0"
NOTE: Guiding Stopped.
-----
[00:16:53] Reported temperature is: 11.4
[00:16:53] Calculating dither distance.
NOTE: Imager image scale is 1.31 AS/Pixel.
[00:17:06] Dithered: 6.2 AS (S), 10.1 AS (W)
[00:17:15] Guider: 5s exposure
[00:17:27] Guider Image completed: LSX2_M_51_Light_00331823.fit
[00:17:27] Selected guide star coordinates: 532.80, 459.57
NOTE: Measuring AG exposure.
NOTE: Exposure 1 of 3 brightness: 1.0
NOTE: Exposure 2 of 3 brightness: 1.0
NOTE: Exposure 3 of 3 brightness: 1.0
NOTE: Average brightness: 1.0
NOTE: Star too bright.
NOTE: Exposure: 2.5 Brightness: 1.0
NOTE: Exposure: 1.25 Brightness: 0.92
NOTE: Exposure: 0.625 Brightness: 0.51
NOTE: Recommend AG exposure of 0.9 and a delay of 4.1.
[00:18:07] Autoguiding started.

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[00:18:08] Guider settle limit set to 0.41 guider pixels.
[00:18:09] Guider ON target. (-0.18, 0.16) (1 of 5)
[00:18:16] Guider off target. (1.32, 0.6) (2 of 30)
[00:18:23] Guider off target. (-0.29, 0.59) (3 of 30)
[00:18:29] Guider off target. (0.15, 0.43) (4 of 30)
[00:18:36] Guider ON target. (-0.29, 0.23) (1 of 5)
[00:18:43] Guider ON target. (-0.17, -0.15) (2 of 5)
[00:18:50] Guider ON target. (0.21, -0.16) (3 of 5)
[00:18:57] Guider off target. (0.45, -0.07) (8 of 30)
[00:19:04] Guider ON target. (0.37, 0.08) (1 of 5)
[00:19:10] Guider ON target. (0.15, 0.07) (2 of 5)
[00:19:17] Guider ON target. (-0.14, 0.11) (3 of 5)
[00:19:24] Guider ON target. (-0.36, 0.04) (4 of 5)
[00:19:31] Guider ON target. (-0.27, -0.1) (5 of 5)
[00:19:37] Continuing.

NOTE: Starting image SET 7 of 20.

NOTE: IMAGE 28 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[00:19:39] Imager: 240s exposure through Clear filter.
[00:24:03] Image completed: SVQ-QSI_M_51_Clear_Light_00131827.fit
NOTE: Setting QSI Camera to faster download mode.
NOTE: Guider Tracking.
NOTE: Statistics:
Filter: Clear
Image Scale: 1.306 AS/Pixel
Image FWHM: 4.55 AS
Average Pixel value: 11211 ADU
Position Angle: 90 degrees
Focuser Position: 5386
Temperature: 11.4
Image Altitude: 79.55
Image Aziumth: 317.83
Image Center (J2k): RA: 13h 29m 50.9s Dec: +47° 11' 34.5"
Image Center (JNow): RA: 13h 30m 37.8s Dec: +47° 06' 04.5"

NOTE: IMAGE 29 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[00:24:16] Imager: 240s exposure through Red filter.
[00:28:38] Image completed: SVQ-QSI_M_51_Red_Light_00131828.fit
NOTE: Setting QSI Camera to faster download mode.
NOTE: Guider Tracking.
NOTE: Statistics:
Filter: Red
Image Scale: 1.306 AS/Pixel
Image FWHM: 3.84 AS
Average Pixel value: 5640 ADU
Position Angle: 90 degrees
Focuser Position: 5383
Temperature: 11.4
Image Altitude: 78.93
Image Aziumth: 315.15
Image Center (J2k): RA: 13h 29m 50.8s Dec: +47° 11' 33.6"
Image Center (JNow): RA: 13h 30m 37.7s Dec: +47° 06' 03.6"

NOTE: IMAGE 30 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[00:28:52] Imager: 240s exposure through Green filter.
[00:33:14] Image completed: SVQ-QSI_M_51_Green_Light_00131829.fit
NOTE: Setting QSI Camera to faster download mode.
NOTE: Guider Tracking.
NOTE: Statistics:
Filter: Green


```

Image Scale:          1.306 AS/Pixel
Image FWHM:           4.7 AS
Average Pixel Value:  5447 ADU
Position Angle:       90 degrees
Focuser Position:     5386
Temperature:          11.3
Image Altitude:       78.3
Image Aziumth:        312.83
Image Center (J2k):   RA: 13h 29m 50.8s  Dec: +47° 11' 33.5"
Image Center (JNow):  RA: 13h 30m 37.7s  Dec: +47° 06' 03.5"
-----
NOTE: IMAGE 31 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[00:33:27] Imager: 240s exposure through Blue filter.
[00:37:50] Image completed: SVQ-QSI_M_51_Blue_Light_00131830.fit
NOTE: Setting QSI Camera to faster download mode.
NOTE: Guider Tracking.
NOTE: Statistics:
Filter:               Blue
Image Scale:          1.306 AS/Pixel
Image FWHM:           5.2 AS
Average Pixel Value:  3933 ADU
Position Angle:       90 degrees
Focuser Position:     5396
Temperature:          11.2
Image Altitude:       77.64
Image Aziumth:        310.8
Image Center (J2k):   RA: 13h 29m 50.8s  Dec: +47° 11' 34.8"
Image Center (JNow):  RA: 13h 30m 37.6s  Dec: +47° 06' 04.8"
NOTE: Guiding Stopped.
-----
[00:38:07] Reported temperature is: 11.2
[00:38:07] Calculating dither distance.
NOTE: Imager image scale is 1.31 AS/Pixel.
[00:38:21] Dithered: 2.6 AS (S), 9.1 AS (E)
[00:38:30] Guider: 5s exposure
[00:38:42] Guider Image completed: LSX2_M_51_Light_00332013.fit
[00:38:42] Selected guide star coordinates: 534.01, 457.72
NOTE: Measuring AG exposure.
NOTE: Exposure 1 of 3 brightness: 0.99
NOTE: Exposure 2 of 3 brightness: 0.99
NOTE: Exposure 3 of 3 brightness: 0.99
NOTE: Average brightness: 0.99
NOTE: Star too bright.
NOTE: Exposure: 2.5 Brightness: 0.99
NOTE: Exposure: 1.25 Brightness: 0.58
NOTE: Recommend AG exposure of 1.5 and a delay of 3.5.
[00:39:18] Autoguiding started.
[00:39:19] Guider settle limit set to 0.41 guider pixels.
[00:39:20] Guider ON target. (0.2, 0.22) (1 of 5)
[00:39:27] Guider off target. (1.28, 0.33) (2 of 30)
[00:39:34] Guider ON target. (0.02, 0.28) (1 of 5)
[00:39:41] Guider ON target. (0.27, 0.0) (2 of 5)
[00:39:48] Guider ON target. (-0.06, -0.03) (3 of 5)
[00:39:55] Guider ON target. (0.03, 0.15) (4 of 5)
[00:40:02] Guider ON target. (0.09, 0.0) (5 of 5)
[00:40:08] Continuing.
-----
NOTE: Starting image SET 8 of 20.
-----
NOTE: IMAGE 32 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[00:40:10] Imager: 240s exposure through Clear filter.
[00:44:34] Image completed: SVQ-QSI_M_51_Clear_Light_00131831.fit

```

NOTE: Setting QSI Camera to faster download mode.
NOTE: Guider Tracking.
NOTE: Statistics:
Filter: Clear
Image Scale: 1.306 AS/Pixel
Image FWHM: 4.98 AS
Average Pixel Value: 11533 ADU
Position Angle: 90 degrees
Focuser Position: 5386
Temperature: 11.2
Image Altitude: 76.64
Image Aziumth: 308.25
Image Center (J2k): RA: 13h 29m 51.5s Dec: +47° 11' 29.6"
Image Center (JNow): RA: 13h 30m 38.4s Dec: +47° 05' 59.6"

NOTE: IMAGE 33 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[00:44:49] Imager: 240s exposure through Red filter.
[00:49:11] Image completed: SVQ-QSI_M_51_Red_Light_00131832.fit
NOTE: Setting QSI Camera to faster download mode.
NOTE: Guider Tracking.
NOTE: Statistics:
Filter: Red
Image Scale: 1.306 AS/Pixel
Image FWHM: 4.09 AS
Average Pixel Value: 5771 ADU
Position Angle: 90 degrees
Focuser Position: 5383
Temperature: 11.2
Image Altitude: 75.94
Image Aziumth: 306.78
Image Center (J2k): RA: 13h 29m 51.5s Dec: +47° 11' 28.0"
Image Center (JNow): RA: 13h 30m 38.3s Dec: +47° 05' 58.0"

NOTE: IMAGE 34 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[00:49:25] Imager: 240s exposure through Green filter.
[00:53:48] Image completed: SVQ-QSI_M_51_Green_Light_00131833.fit
NOTE: Setting QSI Camera to faster download mode.
NOTE: Guider Tracking.
NOTE: Statistics:
Filter: Green
Image Scale: 1.306 AS/Pixel
Image FWHM: 4.92 AS
Average Pixel Value: 5612 ADU
Position Angle: 90 degrees
Focuser Position: 5386
Temperature: 11.2
Image Altitude: 75.21
Image Aziumth: 305.47
Image Center (J2k): RA: 13h 29m 51.4s Dec: +47° 11' 28.1"
Image Center (JNow): RA: 13h 30m 38.3s Dec: +47° 05' 58.1"

NOTE: IMAGE 35 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[00:54:01] Imager: 240s exposure through Blue filter.
[00:58:25] Image completed: SVQ-QSI_M_51_Blue_Light_00131834.fit
NOTE: Setting QSI Camera to faster download mode.
NOTE: Guider Tracking.
NOTE: Statistics:
Filter: Blue
Image Scale: 1.306 AS/Pixel
Image FWHM: 5.84 AS
Average Pixel Value: 4092 ADU

Position Angle: 90 degrees
Focuser Position: 5396
Temperature: 11.2
Image Altitude: 74.49
Image Azimuth: 304.33
Image Center (J2k): RA: 13h 29m 51.4s Dec: +47° 11' 29.1"
Image Center (JNow): RA: 13h 30m 38.2s Dec: +47° 05' 59.1"

NOTE: Guiding Stopped.

[00:58:43] Reported temperature is: 11.2
[00:58:44] Calculating dither distance.
NOTE: Imager image scale is 1.31 AS/Pixel.
[00:58:57] Dithered: 6.3 AS (N), 6.7 AS (W)
[00:59:06] Guider: 5s exposure
[00:59:17] Guider Image completed: LSX2_M_51_Light_00332225.fit
[00:59:18] Selected guide star coordinates: 532.66, 461.11
NOTE: Measuring AG exposure.
NOTE: Exposure 1 of 3 brightness: 1.0
NOTE: Exposure 2 of 3 brightness: 1.0
NOTE: Exposure 3 of 3 brightness: 1.0
NOTE: Average brightness: 1.0
NOTE: Star too bright.
NOTE: Exposure: 2.5 Brightness: 1.0
NOTE: Exposure: 1.25 Brightness: 0.99
NOTE: Exposure: 0.625 Brightness: 0.61
NOTE: Recommend AG exposure of 0.7 and a delay of 4.3.
[00:59:57] Autoguiding started.
[00:59:58] Guider settle limit set to 0.41 guider pixels.
[00:59:59] Guider ON target. (0.4, 0.23) (1 of 5)
[01:00:06] Guider ON target. (-0.04, 0.39) (2 of 5)
[01:00:13] Guider off target. (-0.8, 0.56) (3 of 30)
[01:00:20] Guider off target. (-0.61, 0.25) (4 of 30)
[01:00:27] Guider ON target. (0.38, 0.21) (1 of 5)
[01:00:34] Guider ON target. (-0.01, 0.12) (2 of 5)
[01:00:40] Guider ON target. (-0.37, 0.24) (3 of 5)
[01:00:47] Guider ON target. (0.33, -0.09) (4 of 5)
[01:00:54] Guider off target. (0.62, 0.05) (9 of 30)
[01:01:01] Guider ON target. (0.08, 0.08) (1 of 5)
[01:01:08] Guider ON target. (0.0, 0.1) (2 of 5)
[01:01:15] Guider ON target. (0.01, -0.35) (3 of 5)
[01:01:22] Guider off target. (0.54, -0.18) (13 of 30)
[01:01:29] Guider off target. (0.58, 0.09) (14 of 30)
[01:01:36] Guider ON target. (-0.08, 0.14) (1 of 5)
[01:01:43] Guider ON target. (-0.33, 0.1) (2 of 5)
[01:01:50] Guider ON target. (-0.21, -0.06) (3 of 5)
[01:01:57] Guider off target. (0.96, 0.06) (18 of 30)
[01:02:04] Guider ON target. (-0.06, -0.19) (1 of 5)
[01:02:11] Guider ON target. (0.14, -0.07) (2 of 5)
[01:02:18] Guider ON target. (0.1, 0.03) (3 of 5)
[01:02:25] Guider ON target. (0.21, 0.25) (4 of 5)
[01:02:32] Guider ON target. (-0.28, 0.1) (5 of 5)
[01:02:38] Continuing.

NOTE: Starting image SET 9 of 20.

NOTE: IMAGE 36 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[01:02:40] Imager: 240s exposure through Clear filter.
[01:07:04] Image completed: svQ-QSI_M_51_Clear_Light_00131835.fit
NOTE: Setting QSI Camera to faster download mode.
NOTE: Guider Tracking.
NOTE: Statistics:
Filter: Clear
Image Scale: 1.306 AS/Pixel

Image FWHM: 5.68 AS
Average Pixel Value: 12036 ADU
Position Angle: 90 degrees
Focuser Position: 5386
Temperature: 11.1
Image Altitude: 73.09
Image Aziumth: 302.56
Image Center (J2k): RA: 13h 29m 50.7s Dec: +47° 11' 31.5"
Image Center (JNow): RA: 13h 30m 37.6s Dec: +47° 06' 01.5"

NOTE: IMAGE 37 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[01:07:18] Imager: 240s exposure through Red filter.
[01:11:41] Image completed: SVQ-QSI_M_51_Red_Light_00131836.fit

NOTE: Setting QSI Camera to faster download mode.
NOTE: Guider Tracking.
NOTE: Statistics:
Filter: Red
Image Scale: 1.306 AS/Pixel
Image FWHM: 4.75 AS
Average Pixel Value: 5994 ADU
Position Angle: 90 degrees
Focuser Position: 5383
Temperature: 11.1
Image Altitude: 72.35
Image Aziumth: 301.78
Image Center (J2k): RA: 13h 29m 50.6s Dec: +47° 11' 31.0"
Image Center (JNow): RA: 13h 30m 37.5s Dec: +47° 06' 01.0"

NOTE: IMAGE 38 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[01:11:54] Imager: 240s exposure through Green filter.
[01:16:17] Image completed: SVQ-QSI_M_51_Green_Light_00131837.fit

NOTE: Setting QSI Camera to faster download mode.
NOTE: Guider Tracking.
NOTE: Statistics:
Filter: Green
Image Scale: 1.306 AS/Pixel
Image FWHM: 5.29 AS
Average Pixel Value: 5813 ADU
Position Angle: 90 degrees
Focuser Position: 5386
Temperature: 11.0
Image Altitude: 71.59
Image Aziumth: 301.1
Image Center (J2k): RA: 13h 29m 50.6s Dec: +47° 11' 31.3"
Image Center (JNow): RA: 13h 30m 37.5s Dec: +47° 06' 01.3"

NOTE: IMAGE 39 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[01:16:30] Imager: 240s exposure through Blue filter.
[01:20:52] Image completed: SVQ-QSI_M_51_Blue_Light_00131838.fit

NOTE: Setting QSI Camera to faster download mode.
NOTE: Guider Tracking.
NOTE: Statistics:
Filter: Blue
Image Scale: 1.306 AS/Pixel
Image FWHM: 5.66 AS
Average Pixel Value: 4262 ADU
Position Angle: 90 degrees
Focuser Position: 5396
Temperature: 10.9
Image Altitude: 70.82
Image Aziumth: 300.5

```

Image Center (J2k): RA: 13h 29m 50.6s Dec: +47° 11' 32.1"
Image Center (JNow): RA: 13h 30m 37.5s Dec: +47° 06' 02.1"
NOTE: Guiding Stopped.
-----
[01:21:09] Reported temperature is: 10.9
[01:21:09] Calculating dither distance.
NOTE: Imager image scale is 1.31 AS/Pixel.
[01:21:22] Dithered: 3.6 AS (S), 4.7 AS (E)
[01:21:31] Guider: 5s exposure
[01:21:44] Guider Image completed: LSX2_M_51_Light_00332431.fit
[01:21:44] Selected guide star coordinates: 534.15, 461.40
NOTE: Measuring AG exposure.
NOTE: Exposure 1 of 3 brightness: 0.99
NOTE: Exposure 2 of 3 brightness: 0.99
NOTE: Exposure 3 of 3 brightness: 0.99
NOTE: Average brightness: 0.99
NOTE: Star too bright.
NOTE: Exposure: 2.5 Brightness: 0.99
NOTE: Exposure: 1.25 Brightness: 0.96
NOTE: Exposure: 0.625 Brightness: 0.36
NOTE: Recommend AG exposure of 0.9375 and a delay of 3.8.
[01:22:23] Autoguiding started.
[01:22:24] Guider settle limit set to 0.41 guider pixels.
[01:22:25] Guider ON target. (0.32, 0.08) (1 of 5)
[01:22:32] Guider off target. (0.23, 0.49) (2 of 30)
[01:22:39] Guider ON target. (-0.24, 0.27) (1 of 5)
[01:22:45] Guider off target. (-0.43, 0.19) (4 of 30)
[01:22:52] Guider ON target. (0.15, 0.07) (1 of 5)
[01:22:59] Guider ON target. (-0.15, 0.16) (2 of 5)
[01:23:05] Guider ON target. (0.02, -0.01) (3 of 5)
[01:23:12] Guider ON target. (0.02, 0.08) (4 of 5)
[01:23:18] Guider ON target. (0.01, -0.21) (5 of 5)
[01:23:24] Continuing.
-----
NOTE: Starting image SET 10 of 20.
-----
NOTE: IMAGE 40 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[01:23:26] Imager: 240s exposure through Clear filter.
[01:27:50] Image completed: SVQ-QSI_M_51_Clear_Light_00131839.fit
NOTE: Setting QSI Camera to faster download mode.
NOTE: Guider Tracking.
NOTE: Statistics:
Filter: Clear
Image Scale: 1.306 AS/Pixel
Image FWHM: 5.34 AS
Average Pixel value: 12468 ADU
Position Angle: 90 degrees
Focuser Position: 5386
Temperature: 10.8
Image Altitude: 69.67
Image Aziumth: 299.74
Image Center (J2k): RA: 13h 29m 50.7s Dec: +47° 11' 26.8"
Image Center (JNow): RA: 13h 30m 37.5s Dec: +47° 05' 56.8"
-----
NOTE: IMAGE 41 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[01:28:03] Imager: 240s exposure through Red filter.
[01:32:26] Image completed: SVQ-QSI_M_51_Red_Light_00131840.fit
NOTE: Setting QSI Camera to faster download mode.
NOTE: Guider Tracking.
NOTE: Statistics:
Filter: Red
Image Scale: 1.306 AS/Pixel

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Image FWHM: 4.75 AS
Average Pixel Value: 6201 ADU
Position Angle: 90 degrees
Focuser Position: 5383
Temperature: 10.8
Image Altitude: 68.9
Image Aziumth: 299.32
Image Center (J2k): RA: 13h 29m 50.6s Dec: +47° 11' 26.3"
Image Center (JNow): RA: 13h 30m 37.5s Dec: +47° 05' 56.3"
-----
NOTE: IMAGE 42 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[01:32:39] Imager: 240s exposure through Green filter.
[01:37:03] Image completed: SVQ-QSI_M_51_Green_Light_00131841.fit
NOTE: Setting QSI Camera to faster download mode.
NOTE: Guider Tracking.
NOTE: Statistics:
Filter: Green
Image Scale: 1.306 AS/Pixel
Image FWHM: 5.77 AS
Average Pixel Value: 6018 ADU
Position Angle: 90 degrees
Focuser Position: 5386
Temperature: 10.7
Image Altitude: 68.13
Image Aziumth: 298.96
Image Center (J2k): RA: 13h 29m 50.6s Dec: +47° 11' 26.3"
Image Center (JNow): RA: 13h 30m 37.5s Dec: +47° 05' 56.4"
-----
NOTE: IMAGE 43 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[01:37:16] Imager: 240s exposure through Blue filter.
[01:41:38] Image completed: SVQ-QSI_M_51_Blue_Light_00131842.fit
NOTE: Setting QSI Camera to faster download mode.
NOTE: Guider Tracking.
NOTE: Statistics:
Filter: Blue
Image Scale: 1.306 AS/Pixel
Image FWHM: 5.77 AS
Average Pixel Value: 4426 ADU
Position Angle: 90 degrees
Focuser Position: 5396
Temperature: 10.6
Image Altitude: 67.34
Image Aziumth: 298.66
Image Center (J2k): RA: 13h 29m 50.6s Dec: +47° 11' 27.1"
Image Center (JNow): RA: 13h 30m 37.4s Dec: +47° 05' 57.1"
NOTE: Guiding Stopped.
-----
[01:41:54] Reported temperature is: 10.6
NOTE: Touching-up Focus.
[01:43:38] @Focus2 success. Position = 5338
[01:43:38] Slew to m51 starting.
NOTE: Slew in progress.
[01:43:53] Arrived at m51
NOTE: Mount currently at: 299.68 az., 65.66 alt.
[01:43:54] Attempting precise positioning with CLS.
[01:44:33] CLS to m51 success (2.612 AS/pixel).
[01:44:34] Reported temperature is: 10.6
[01:44:34] Calculating dither distance.
NOTE: Imager image scale is 1.31 AS/Pixel.
[01:44:47] Dithered: 7.5 AS (N), 7.8 AS (W)
[01:44:56] Guider: 5s exposure
[01:45:08] Guider Image completed: LSX2_M_51_Light_00332623.fit

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[01:45:08] Selected guide star coordinates: 526.55, 456.70
NOTE: Measuring AG exposure.
NOTE: Exposure 1 of 3 brightness: 1.0
NOTE: Exposure 2 of 3 brightness: 1.0
NOTE: Exposure 3 of 3 brightness: 1.0
NOTE: Average brightness: 1.0
NOTE: Star too bright.
NOTE: Exposure: 2.5 Brightness: 0.99
NOTE: Exposure: 1.25 Brightness: 0.85
NOTE: Recommend AG exposure of 1.0 and a delay of 4.0.
[01:45:44] Autoguiding started.
[01:45:45] Guider settle limit set to 0.41 guider pixels.
[01:45:46] Guider ON target. (0.14, -0.16) (1 of 5)
[01:45:53] Guider off target. (1.05, 0.55) (2 of 30)
[01:46:00] Guider off target. (-1.28, 0.55) (3 of 30)
[01:46:07] Guider ON target. (-0.11, -0.05) (1 of 5)
[01:46:14] Guider ON target. (0.19, 0.04) (2 of 5)
[01:46:21] Guider ON target. (0.08, 0.13) (3 of 5)
[01:46:27] Guider ON target. (0.21, -0.13) (4 of 5)
[01:46:34] Guider ON target. (0.28, -0.17) (5 of 5)
[01:46:40] Continuing.
-----
NOTE: Starting image SET 11 of 20.
-----
NOTE: IMAGE 44 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[01:46:43] Imager: 240s exposure through Clear filter.
[01:51:02] Image completed: SVQ-QSI_M_51_Clear_Light_00131882.fit
NOTE: Setting QSI Camera to faster download mode.
NOTE: Guider Tracking.
NOTE: Statistics:
Filter: Clear
Image Scale: 1.306 AS/Pixel
Image FWHM: 4.86 AS
Average Pixel value: 13040 ADU
Position Angle: 90 degrees
Focuser Position: 5338
Temperature: 10.6
Image Altitude: 65.75
Image Aziumth: 298.19
Image Center (J2k): RA: 13h 29m 52.3s Dec: +47° 11' 48.8"
Image Center (JNow): RA: 13h 30m 39.2s Dec: +47° 06' 18.8"
-----
NOTE: IMAGE 45 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[01:51:18] Imager: 240s exposure through Red filter.
[01:55:41] Image completed: SVQ-QSI_M_51_Red_Light_00131883.fit
NOTE: Setting QSI Camera to faster download mode.
NOTE: Guider Tracking.
NOTE: Statistics:
Filter: Red
Image Scale: 1.306 AS/Pixel
Image FWHM: 4.5 AS
Average Pixel value: 6466 ADU
Position Angle: 90 degrees
Focuser Position: 5335
Temperature: 10.5
Image Altitude: 64.97
Image Aziumth: 298.02
Image Center (J2k): RA: 13h 29m 52.3s Dec: +47° 11' 48.8"
Image Center (JNow): RA: 13h 30m 39.1s Dec: +47° 06' 18.8"
-----
NOTE: IMAGE 46 OF 83.
NOTE: Setting QSI Camera to high quality mode.

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[01:55:56] Imager: 240s exposure through Green filter.
 [02:00:18] Image completed: SVQ-QSI_M_51_Green_Light_00131884.fit
 NOTE: Setting QSI Camera to faster download mode.
 NOTE: Guider Tracking.
 NOTE: Statistics:
 Filter: Green
 Image Scale: 1.306 AS/Pixel
 Image FWHM: 4.49 AS
 Average Pixel Value: 6269 ADU
 Position Angle: 90 degrees
 Focuser Position: 5338
 Temperature: 10.4
 Image Altitude: 64.17
 Image Aziumth: 297.88
 Image Center (J2k): RA: 13h 29m 52.2s Dec: +47° 11' 48.9"
 Image Center (JNow): RA: 13h 30m 39.1s Dec: +47° 06' 19.0"

 NOTE: IMAGE 47 OF 83.
 NOTE: Setting QSI Camera to high quality mode.
 [02:00:33] Imager: 240s exposure through Blue filter.
 [02:04:56] Image completed: SVQ-QSI_M_51_Blue_Light_00131885.fit
 NOTE: Setting QSI Camera to faster download mode.
 NOTE: Guider Tracking.
 NOTE: Statistics:
 Filter: Blue
 Image Scale: 1.306 AS/Pixel
 Image FWHM: 5.31 AS
 Average Pixel Value: 4586 ADU
 Position Angle: 90 degrees
 Focuser Position: 5348
 Temperature: 10.3
 Image Altitude: 63.39
 Image Aziumth: 297.78
 Image Center (J2k): RA: 13h 29m 52.2s Dec: +47° 11' 49.4"
 Image Center (JNow): RA: 13h 30m 39.0s Dec: +47° 06' 19.5"
 NOTE: Guiding Stopped.

 [02:05:13] Reported temperature is: 10.3
 [02:05:14] Calculating dither distance.
 NOTE: Imager image scale is 1.31 AS/Pixel.
 [02:05:27] Dithered: 6.1 AS (N), 6.1 AS (W)
 [02:05:36] Guider: 5s exposure
 [02:05:48] Guider Image completed: LSX2_M_51_Light_00332835.fit
 [02:05:48] Selected guide star coordinates: 525.27, 458.61
 NOTE: Measuring AG exposure.
 NOTE: Exposure 1 of 3 brightness: 0.99
 NOTE: Exposure 2 of 3 brightness: 0.99
 NOTE: Exposure 3 of 3 brightness: 0.99
 NOTE: Average brightness: 0.99
 NOTE: Star too bright.
 NOTE: Exposure: 2.5 Brightness: 0.99
 NOTE: Exposure: 1.25 Brightness: 0.86
 NOTE: Recommend AG exposure of 1.0 and a delay of 4.0.
 [02:06:24] Autoguiding started.
 [02:06:25] Guider settle limit set to 0.41 guider pixels.
 [02:06:26] Guider ON target. (0.31, -0.28) (1 of 5)
 [02:06:34] Guider off target. (0.21, 0.82) (2 of 30)
 [02:06:41] Guider off target. (-0.93, 0.19) (3 of 30)
 [02:06:48] Guider ON target. (-0.1, 0.29) (1 of 5)
 [02:06:55] Guider ON target. (-0.36, 0.21) (2 of 5)
 [02:07:02] Guider ON target. (0.11, -0.06) (3 of 5)
 [02:07:09] Guider ON target. (-0.27, 0.15) (4 of 5)
 [02:07:15] Guider ON target. (0.24, -0.19) (5 of 5)
 [02:07:21] Continuing.


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-----
NOTE: Starting image SET 12 of 20.
-----
NOTE: IMAGE 48 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[02:07:24] Imager: 240s exposure through Clear filter.
[02:11:47] Image completed: SVQ-QSI_M_51_Clear_Light_00131886.fit
NOTE: Setting QSI Camera to faster download mode.
NOTE: Guider Tracking.
NOTE: Statistics:
      Filter:          Clear
      Image Scale:     1.306 AS/Pixel
      Image FWHM:      5.19 AS
      Average Pixel Value: 13499 ADU
      Position Angle:  90 degrees
      Focuser Position: 5338
      Temperature:     10.3
      Image Altitude:  62.22
      Image Aziumth:    297.69
      Image Center (J2k): RA: 13h 29m 51.8s  Dec: +47° 11' 53.1"
      Image Center (JNow): RA: 13h 30m 38.7s  Dec: +47° 06' 23.1"
-----
NOTE: IMAGE 49 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[02:12:01] Imager: 240s exposure through Red filter.
[02:16:24] Image completed: SVQ-QSI_M_51_Red_Light_00131887.fit
NOTE: Setting QSI Camera to faster download mode.
NOTE: Guider Tracking.
NOTE: Statistics:
      Filter:          Red
      Image Scale:     1.306 AS/Pixel
      Image FWHM:      4.14 AS
      Average Pixel Value: 6698 ADU
      Position Angle:  90 degrees
      Focuser Position: 5335
      Temperature:     10.3
      Image Altitude:  61.43
      Image Aziumth:    297.66
      Image Center (J2k): RA: 13h 29m 51.8s  Dec: +47° 11' 53.1"
      Image Center (JNow): RA: 13h 30m 38.6s  Dec: +47° 06' 23.1"
-----
NOTE: IMAGE 50 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[02:16:38] Imager: 240s exposure through Green filter.
[02:21:01] Image completed: SVQ-QSI_M_51_Green_Light_00131888.fit
NOTE: Setting QSI Camera to faster download mode.
NOTE: Guider Tracking.
NOTE: Statistics:
      Filter:          Green
      Image Scale:     1.306 AS/Pixel
      Image FWHM:      5.22 AS
      Average Pixel Value: 6513 ADU
      Position Angle:  90 degrees
      Focuser Position: 5338
      Temperature:     10.3
      Image Altitude:  60.65
      Image Aziumth:    297.65
      Image Center (J2k): RA: 13h 29m 51.7s  Dec: +47° 11' 53.2"
      Image Center (JNow): RA: 13h 30m 38.6s  Dec: +47° 06' 23.3"
-----
NOTE: IMAGE 51 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[02:21:16] Imager: 240s exposure through Blue filter.
[02:25:39] Image completed: SVQ-QSI_M_51_Blue_Light_00131889.fit

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NOTE: Setting QSI Camera to faster download mode.

NOTE: Guider Tracking.

NOTE: Statistics:

Filter: Blue
Image Scale: 1.306 AS/Pixel
Image FWHM: 5.35 AS
Average Pixel Value: 4771 ADU
Position Angle: 90 degrees
Focuser Position: 5348
Temperature: 10.2
Image Altitude: 59.85
Image Aziumth: 297.67
Image Center (J2k): RA: 13h 29m 51.7s Dec: +47° 11' 53.7"
Image Center (JNow): RA: 13h 30m 38.5s Dec: +47° 06' 23.7"

NOTE: Guiding Stopped.

[02:25:55] Reported temperature is: 10.2
[02:25:56] Calculating dither distance.
NOTE: Imager image scale is 1.31 AS/Pixel.
[02:26:09] Dithered: 1.0 AS (S), 4.1 AS (E)
[02:26:18] Guider: 5s exposure
[02:26:30] Guider Image completed: LSX2_M_51_Light_00333048.fit
[02:26:30] Selected guide star coordinates: 525.97, 458.53
NOTE: Measuring AG exposure.
NOTE: Exposure 1 of 3 brightness: 1.0
NOTE: Exposure 2 of 3 brightness: 1.0
NOTE: Exposure 3 of 3 brightness: 1.0
NOTE: Average brightness: 1.0
NOTE: Star too bright.
NOTE: Exposure: 2.5 Brightness: 1.0
NOTE: Exposure: 1.25 Brightness: 0.56
NOTE: Recommend AG exposure of 1.6 and a delay of 3.4.
[02:27:06] Autoguiding started.
[02:27:07] Guider settle limit set to 0.41 guider pixels.
[02:27:07] Guider ON target. (-0.03, 0.03) (1 of 5)
[02:27:14] Guider off target. (1.14, 0.7) (2 of 30)
[02:27:21] Guider ON target. (0.12, 0.24) (1 of 5)
[02:27:28] Guider ON target. (0.29, 0.08) (2 of 5)
[02:27:35] Guider ON target. (-0.16, 0.0) (3 of 5)
[02:27:43] Guider ON target. (0.03, 0.09) (4 of 5)
[02:27:50] Guider ON target. (0.09, -0.01) (5 of 5)
[02:27:56] Continuing.

NOTE: Starting image SET 13 of 20.

NOTE: IMAGE 52 OF 83.

NOTE: Setting QSI Camera to high quality mode.

[02:27:58] Imager: 240s exposure through Clear filter.

[02:32:22] Image completed: SVQ-QSI_M_51_Clear_Light_00131890.fit

NOTE: Setting QSI Camera to faster download mode.

NOTE: Guider Tracking.

NOTE: Statistics:

Filter: Clear
Image Scale: 1.306 AS/Pixel
Image FWHM: 5.2 AS
Average Pixel Value: 14108 ADU
Position Angle: 90 degrees
Focuser Position: 5338
Temperature: 10.1
Image Altitude: 58.71
Image Aziumth: 297.73
Image Center (J2k): RA: 13h 29m 51.8s Dec: +47° 11' 51.0"
Image Center (JNow): RA: 13h 30m 38.7s Dec: +47° 06' 21.0"

NOTE: IMAGE 53 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[02:32:36] Imager: 240s exposure through Red filter.
[02:36:59] Image completed: SVQ-QSI_M_51_Red_Light_00131891.fit
NOTE: Setting QSI Camera to faster download mode.
NOTE: Guider Tracking.
NOTE: Statistics:
Filter: Red
Image Scale: 1.306 AS/Pixel
Image FWHM: 4.79 AS
Average Pixel Value: 7010 ADU
Position Angle: 90 degrees
Focuser Position: 5335
Temperature: 10.0
Image Altitude: 57.92
Image Aziumth: 297.8
Image Center (J2k): RA: 13h 29m 51.8s Dec: +47° 11' 50.8"
Image Center (JNow): RA: 13h 30m 38.7s Dec: +47° 06' 20.9"

NOTE: IMAGE 54 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[02:37:13] Imager: 240s exposure through Green filter.
[02:41:36] Image completed: SVQ-QSI_M_51_Green_Light_00131892.fit
NOTE: Setting QSI Camera to faster download mode.
NOTE: Guider Tracking.
NOTE: Statistics:
Filter: Green
Image Scale: 1.306 AS/Pixel
Image FWHM: 5.79 AS
Average Pixel Value: 6816 ADU
Position Angle: 90 degrees
Focuser Position: 5338
Temperature: 9.9
Image Altitude: 57.14
Image Aziumth: 297.89
Image Center (J2k): RA: 13h 29m 51.8s Dec: +47° 11' 50.9"
Image Center (JNow): RA: 13h 30m 38.6s Dec: +47° 06' 20.9"

NOTE: IMAGE 55 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[02:41:50] Imager: 240s exposure through Blue filter.
[02:46:13] Image completed: SVQ-QSI_M_51_Blue_Light_00131893.fit
NOTE: Setting QSI Camera to faster download mode.
NOTE: Guider Tracking.
NOTE: Statistics:
Filter: Blue
Image Scale: 1.306 AS/Pixel
Image FWHM: 6.12 AS
Average Pixel Value: 4964 ADU
Position Angle: 90 degrees
Focuser Position: 5348
Temperature: 9.9
Image Altitude: 56.34
Image Aziumth: 297.99
Image Center (J2k): RA: 13h 29m 51.7s Dec: +47° 11' 51.5"
Image Center (JNow): RA: 13h 30m 38.6s Dec: +47° 06' 21.5"

NOTE: Guiding Stopped.

[02:46:31] Reported temperature is: 9.9
[02:46:31] Calculating dither distance.
NOTE: Imager image scale is 1.31 AS/Pixel.
[02:46:44] Dithered: 6.7 AS (S), 9.8 AS (W)
[02:46:53] Guider: 5s exposure
[02:47:05] Guider Image completed: LSX2_M_51_Light_00333261.fit

```

[02:47:05] Selected guide star coordinates: 528.57, 462.49
NOTE: Measuring AG exposure.
NOTE: Exposure 1 of 3 brightness: 0.99
NOTE: Exposure 2 of 3 brightness: 0.99
NOTE: Exposure 3 of 3 brightness: 0.99
NOTE: Average brightness: 0.99
NOTE: Star too bright.
NOTE: Exposure: 2.5 Brightness: 0.99
NOTE: Exposure: 1.25 Brightness: 0.99
NOTE: Exposure: 0.625 Brightness: 0.25
NOTE: Recommend AG exposure of 0.9375 and a delay of 3.3.
[02:47:44] Autoguiding started.
[02:47:45] Guider settle limit set to 0.41 guider pixels.
[02:47:46] Guider ON target. (-0.18, -0.11) (1 of 5)
[02:47:52] Guider off target. (0.19, 0.73) (2 of 30)
[02:47:59] Guider ON target. (-0.19, 0.13) (1 of 5)
[02:48:05] Guider ON target. (-0.13, 0.39) (2 of 5)
[02:48:11] Guider ON target. (0.37, -0.19) (3 of 5)
[02:48:17] Guider off target. (0.69, -0.05) (6 of 30)
[02:48:23] Guider ON target. (0.0, -0.18) (1 of 5)
[02:48:29] Guider off target. (0.57, -0.18) (8 of 30)
[02:48:35] Guider ON target. (0.21, 0.08) (1 of 5)
[02:48:41] Guider ON target. (-0.07, 0.19) (2 of 5)
[02:48:47] Guider ON target. (-0.31, 0.15) (3 of 5)
[02:48:53] Guider ON target. (-0.13, 0.02) (4 of 5)
[02:48:59] Guider ON target. (-0.15, 0.19) (5 of 5)
[02:49:04] Continuing.
-----
NOTE: Starting image SET 14 of 20.
-----
NOTE: IMAGE 56 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[02:49:07] Imager: 240s exposure through Clear filter.
[02:53:31] Image completed: SVQ-QSI_M_51_Clear_Light_00131894.fit
NOTE: Setting QSI Camera to faster download mode.
NOTE: Guider Tracking.
NOTE: Statistics:
Filter: Clear
Image Scale: 1.306 AS/Pixel
Image FWHM: 6.43 AS
Average Pixel value: 14734 ADU
Position Angle: 90 degrees
Focuser Position: 5338
Temperature: 9.8
Image Altitude: 55.11
Image Aziumth: 298.19
Image Center (J2k): RA: 13h 29m 50.7s Dec: +47° 11' 43.5"
Image Center (JNow): RA: 13h 30m 37.5s Dec: +47° 06' 13.5"
-----
NOTE: IMAGE 57 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[02:53:44] Imager: 240s exposure through Red filter.
[02:58:07] Image completed: SVQ-QSI_M_51_Red_Light_00131895.fit
NOTE: Setting QSI Camera to faster download mode.
NOTE: Guider Tracking.
NOTE: Statistics:
Filter: Red
Image Scale: 1.306 AS/Pixel
Image FWHM: 5.01 AS
Average Pixel value: 7316 ADU
Position Angle: 90 degrees
Focuser Position: 5335
Temperature: 9.8
Image Altitude: 54.33

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Image Aziumth:      298.33
Image Center (J2k): RA: 13h 29m 50.6s  Dec: +47° 11' 43.5"
Image Center (JNow): RA: 13h 30m 37.5s  Dec: +47° 06' 13.6"
-----
NOTE: IMAGE 58 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[02:58:21] Imager: 240s exposure through Green filter.
[03:02:44] Image completed: SVQ-QSI_M_51_Green_Light_00131896.fit
NOTE: Setting QSI Camera to faster download mode.
NOTE: Guider Tracking.
NOTE: Statistics:
Filter:              Green
Image Scale:         1.306 AS/Pixel
Image FWHM:          6.42 AS
Average Pixel Value: 7119 ADU
Position Angle:      90 degrees
Focuser Position:    5338
Temperature:         9.8
Image Altitude:      53.54
Image Aziumth:       298.49
Image Center (J2k):  RA: 13h 29m 50.5s  Dec: +47° 11' 43.5"
Image Center (JNow): RA: 13h 30m 37.4s  Dec: +47° 06' 13.6"
-----
NOTE: IMAGE 59 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[03:02:58] Imager: 240s exposure through Blue filter.
[03:07:21] Image completed: SVQ-QSI_M_51_Blue_Light_00131897.fit
NOTE: Setting QSI Camera to faster download mode.
NOTE: Guider Tracking.
NOTE: Statistics:
Filter:              Blue
Image Scale:         1.306 AS/Pixel
Image FWHM:          6.69 AS
Average Pixel Value: 5192 ADU
Position Angle:      90 degrees
Focuser Position:    5348
Temperature:         9.6
Image Altitude:      52.76
Image Aziumth:       298.66
Image Center (J2k):  RA: 13h 29m 50.5s  Dec: +47° 11' 44.4"
Image Center (JNow): RA: 13h 30m 37.4s  Dec: +47° 06' 14.4"
NOTE: Guiding Stopped.
-----
[03:07:38] Reported temperature is: 9.6
NOTE: Touching-up Focus.
[03:09:22] @Focus2 success. Position = 5285
[03:09:22] Slew to m51 starting.
NOTE: Slew in progress.
[03:09:36] Arrived at m51
NOTE: Mount currently at: 300.03 az., 51.24 alt.
[03:09:37] Attempting precise positioning with CLS.
[03:10:15] CLS to m51 success (2.613 AS/pixel).
[03:10:16] Reported temperature is: 9.6
[03:10:16] Calculating dither distance.
NOTE: Imager image scale is 1.31 AS/Pixel.
[03:10:29] Dithered: 5.1 AS (N), 11.1 AS (E)
[03:10:38] Guider: 5s exposure
[03:10:50] Guider Image completed: LSX2_M_51_Light_00333473.fit
[03:10:50] Selected guide star coordinates: 526.93, 450.40
NOTE: Measuring AG exposure.
NOTE: Exposure 1 of 3 brightness: 0.99
NOTE: Exposure 2 of 3 brightness: 0.99
NOTE: Exposure 3 of 3 brightness: 0.99
NOTE: Average brightness: 0.99

```

NOTE: Star too bright.
 NOTE: Exposure: 2.5 Brightness: 0.99
 NOTE: Exposure: 1.25 Brightness: 0.79
 NOTE: Recommend AG exposure of 1.1 and a delay of 3.9.
 [03:11:26] Autoguiding started.
 [03:11:27] Guider settle limit set to 0.41 guider pixels.
 [03:11:28] Guider ON target. (0.1, 0.05) (1 of 5)
 [03:11:35] Guider off target. (0.99, 0.53) (2 of 30)
 [03:11:42] Guider off target. (-0.68, 0.54) (3 of 30)
 [03:11:49] Guider ON target. (-0.3, 0.37) (1 of 5)
 [03:11:56] Guider off target. (0.56, -0.23) (5 of 30)
 [03:12:03] Guider off target. (0.82, -0.15) (6 of 30)
 [03:12:10] Guider off target. (1.02, -0.17) (7 of 30)
 [03:12:16] Guider off target. (0.65, -0.13) (8 of 30)
 [03:12:23] Guider ON target. (-0.3, -0.06) (1 of 5)
 [03:12:31] Guider ON target. (0.21, 0.12) (2 of 5)
 [03:12:37] Guider ON target. (-0.34, -0.09) (3 of 5)
 [03:12:45] Guider ON target. (0.0, 0.08) (4 of 5)
 [03:12:52] Guider ON target. (0.06, 0.01) (5 of 5)
 [03:12:58] Continuing.

 NOTE: Starting image SET 15 of 20.

 NOTE: IMAGE 60 OF 83.
 NOTE: Setting QSI Camera to high quality mode.
 [03:13:00] Imager: 240s exposure through Clear filter.
 [03:17:19] Image completed: SVQ-QSI_M_51_Clear_Light_00131937.fit
 NOTE: Setting QSI Camera to faster download mode.
 NOTE: Guider Tracking.
 NOTE: Statistics:
 Filter: Clear
 Image Scale: 1.306 AS/Pixel
 Image FWHM: 4.93 AS
 Average Pixel Value: 15725 ADU
 Position Angle: 90 degrees
 Focuser Position: 5285
 Temperature: 9.4
 Image Altitude: 51.07
 Image Aziumth: 299.08
 Image Center (J2k): RA: 13h 29m 54.2s Dec: +47° 11' 46.3"
 Image Center (JNow): RA: 13h 30m 41.1s Dec: +47° 06' 16.4"

 NOTE: IMAGE 61 OF 83.
 NOTE: Setting QSI Camera to high quality mode.
 [03:17:34] Imager: 240s exposure through Red filter.
 [03:21:58] Image completed: SVQ-QSI_M_51_Red_Light_00131938.fit
 NOTE: Setting QSI Camera to faster download mode.
 NOTE: Guider Tracking.
 NOTE: Statistics:
 Filter: Red
 Image Scale: 1.306 AS/Pixel
 Image FWHM: 4.79 AS
 Average Pixel Value: 7808 ADU
 Position Angle: 90 degrees
 Focuser Position: 5282
 Temperature: 9.4
 Image Altitude: 50.3
 Image Aziumth: 299.29
 Image Center (J2k): RA: 13h 29m 54.2s Dec: +47° 11' 46.6"
 Image Center (JNow): RA: 13h 30m 41.1s Dec: +47° 06' 16.7"

 NOTE: IMAGE 62 OF 83.
 NOTE: Setting QSI Camera to high quality mode.
 [03:22:12] Imager: 240s exposure through Green filter.

[03:26:35] Image completed: SVQ-QSI_M_51_Green_Light_00131939.fit
 NOTE: Setting QSI Camera to faster download mode.
 NOTE: Guider Tracking.
 NOTE: Statistics:
 Filter: Green
 Image Scale: 1.306 AS/Pixel
 Image FWHM: 4.97 AS
 Average Pixel Value: 7576 ADU
 Position Angle: 90 degrees
 Focuser Position: 5285
 Temperature: 9.3
 Image Altitude: 49.53
 Image Aziumth: 299.51
 Image Center (J2k): RA: 13h 29m 54.2s Dec: +47° 11' 46.6"
 Image Center (JNow): RA: 13h 30m 41.1s Dec: +47° 06' 16.7"

 NOTE: IMAGE 63 OF 83.
 NOTE: Setting QSI Camera to high quality mode.
 [03:26:49] Imager: 240s exposure through Blue filter.
 [03:31:12] Image completed: SVQ-QSI_M_51_Blue_Light_00131940.fit
 NOTE: Setting QSI Camera to faster download mode.
 NOTE: Guider Tracking.
 NOTE: Statistics:
 Filter: Blue
 Image Scale: 1.306 AS/Pixel
 Image FWHM: 5.71 AS
 Average Pixel Value: 5481 ADU
 Position Angle: 90 degrees
 Focuser Position: 5295
 Temperature: 9.2
 Image Altitude: 48.76
 Image Aziumth: 299.74
 Image Center (J2k): RA: 13h 29m 54.2s Dec: +47° 11' 47.8"
 Image Center (JNow): RA: 13h 30m 41.1s Dec: +47° 06' 17.9"
 NOTE: Guiding Stopped.

 [03:31:28] Reported temperature is: 9.2
 [03:31:29] Calculating dither distance.
 NOTE: Imager image scale is 1.31 AS/Pixel.
 [03:31:42] Dithered: 3.3 AS (N), 3.6 AS (E)
 [03:31:52] Guider: 5s exposure
 [03:32:03] Guider Image completed: LSX2_M_51_Light_00333692.fit
 [03:32:04] Selected guide star coordinates: 526.54, 449.18
 NOTE: Measuring AG exposure.
 NOTE: Exposure 1 of 3 brightness: 0.99
 NOTE: Exposure 2 of 3 brightness: 0.99
 NOTE: Exposure 3 of 3 brightness: 0.99
 NOTE: Average brightness: 0.99
 NOTE: Star too bright.
 NOTE: Exposure: 2.5 Brightness: 0.99
 NOTE: Exposure: 1.25 Brightness: 0.7
 NOTE: Recommend AG exposure of 1.2 and a delay of 3.8.
 [03:32:40] Autoguiding started.
 [03:32:41] Guider settle limit set to 0.41 guider pixels.
 [03:32:42] Guider off target. (-0.51, -0.06) (1 of 30)
 [03:32:49] Guider off target. (0.19, 0.52) (2 of 30)
 [03:32:56] Guider off target. (-1.03, 0.42) (3 of 30)
 [03:33:03] Guider ON target. (-0.11, 0.1) (1 of 5)
 [03:33:10] Guider off target. (-0.47, 0.06) (5 of 30)
 [03:33:17] Guider ON target. (-0.02, -0.09) (1 of 5)
 [03:33:24] Guider ON target. (0.07, 0.09) (2 of 5)
 [03:33:31] Guider ON target. (-0.11, 0.07) (3 of 5)
 [03:33:38] Guider ON target. (0.32, 0.23) (4 of 5)
 [03:33:45] Guider ON target. (-0.15, -0.07) (5 of 5)

[03:33:51] Continuing.

NOTE: Starting image SET 16 of 20.

NOTE: IMAGE 64 OF 83.

NOTE: Setting QSI Camera to high quality mode.

[03:33:53] Imager: 240s exposure through Clear filter.

[03:38:18] Image completed: SVQ-QSI_M_51_Clear_Light_00131941.fit

NOTE: Setting QSI Camera to faster download mode.

NOTE: Guider Tracking.

NOTE: Statistics:

Filter: Clear
Image Scale: 1.306 AS/Pixel
Image FWHM: 5.55 AS
Average Pixel Value: 16568 ADU
Position Angle: 90 degrees
Focuser Position: 5285
Temperature: 9.1
Image Altitude: 47.58
Image Aziumth: 300.11
Image Center (J2k): RA: 13h 29m 54.6s Dec: +47° 11' 47.8"
Image Center (JNow): RA: 13h 30m 41.5s Dec: +47° 06' 17.9"

NOTE: IMAGE 65 OF 83.

NOTE: Setting QSI Camera to high quality mode.

[03:38:32] Imager: 240s exposure through Red filter.

[03:42:55] Image completed: SVQ-QSI_M_51_Red_Light_00131942.fit

NOTE: Setting QSI Camera to faster download mode.

NOTE: Guider Tracking.

NOTE: Statistics:

Filter: Red
Image Scale: 1.306 AS/Pixel
Image FWHM: 4.57 AS
Average Pixel Value: 8221 ADU
Position Angle: 90 degrees
Focuser Position: 5282
Temperature: 9.1
Image Altitude: 46.81
Image Aziumth: 300.38
Image Center (J2k): RA: 13h 29m 54.6s Dec: +47° 11' 48.1"
Image Center (JNow): RA: 13h 30m 41.5s Dec: +47° 06' 18.1"

NOTE: IMAGE 66 OF 83.

NOTE: Setting QSI Camera to high quality mode.

[03:43:09] Imager: 240s exposure through Green filter.

[03:47:32] Image completed: SVQ-QSI_M_51_Green_Light_00131943.fit

NOTE: Setting QSI Camera to faster download mode.

NOTE: Guider Tracking.

NOTE: Statistics:

Filter: Green
Image Scale: 1.306 AS/Pixel
Image FWHM: 5.74 AS
Average Pixel Value: 8012 ADU
Position Angle: 90 degrees
Focuser Position: 5285
Temperature: 9.0
Image Altitude: 46.05
Image Aziumth: 300.64
Image Center (J2k): RA: 13h 29m 54.6s Dec: +47° 11' 48.1"
Image Center (JNow): RA: 13h 30m 41.4s Dec: +47° 06' 18.2"

NOTE: IMAGE 67 OF 83.

NOTE: Setting QSI Camera to high quality mode.

[03:47:46] Imager: 240s exposure through Blue filter.

[03:52:08] Image completed: SVQ-QSI_M_51_Blue_Light_00131944.fit
NOTE: Setting QSI Camera to faster download mode.
NOTE: Guider Tracking.
NOTE: Statistics:
Filter: Blue
Image Scale: 1.306 AS/Pixel
Image FWHM: 5.77 AS
Average Pixel value: 5795 ADU
Position Angle: 90 degrees
Focuser Position: 5295
Temperature: 8.9
Image Altitude: 45.27
Image Aziumth: 300.92
Image Center (J2k): RA: 13h 29m 54.5s Dec: +47° 11' 48.9"
Image Center (JNow): RA: 13h 30m 41.4s Dec: +47° 06' 19.0"
NOTE: Guiding Stopped.

[03:52:26] Reported temperature is: 8.9
[03:52:27] Calculating dither distance.
NOTE: Imager image scale is 1.31 AS/Pixel.
[03:52:40] Dithered: 7.5 AS (N), 8.0 AS (E)
[03:52:49] Guider: 5s exposure
[03:53:01] Guider Image completed: LSX2_M_51_Light_00333907.fit
[03:53:01] Selected guide star coordinates: 524.58, 446.14
NOTE: Measuring AG exposure.
NOTE: Exposure 1 of 3 brightness: 0.99
NOTE: Exposure 2 of 3 brightness: 0.99
NOTE: Exposure 3 of 3 brightness: 0.99
NOTE: Average brightness: 0.99
NOTE: Star too bright.
NOTE: Exposure: 2.5 Brightness: 0.99
NOTE: Exposure: 1.25 Brightness: 0.93
NOTE: Exposure: 0.625 Brightness: 0.48
NOTE: Recommend AG exposure of 0.9 and a delay of 4.1.
[03:53:41] Autoguiding started.
[03:53:42] Guider settle limit set to 0.41 guider pixels.
[03:53:43] Guider off target. (0.44, 0.01) (1 of 30)
[03:53:49] Guider off target. (0.82, 0.6) (2 of 30)
[03:53:56] Guider off target. (-1.02, 0.41) (3 of 30)
[03:54:03] Guider off target. (-0.48, -0.0) (4 of 30)
[03:54:10] Guider ON target. (-0.25, -0.0) (1 of 5)
[03:54:17] Guider ON target. (0.33, 0.23) (2 of 5)
[03:54:24] Guider ON target. (-0.4, -0.04) (3 of 5)
[03:54:31] Guider ON target. (0.37, -0.01) (4 of 5)
[03:54:38] Guider ON target. (-0.23, -0.01) (5 of 5)
[03:54:44] Continuing.

NOTE: Starting image SET 17 of 20.

NOTE: IMAGE 68 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[03:54:46] Imager: 240s exposure through Clear filter.
[03:59:10] Image completed: SVQ-QSI_M_51_Clear_Light_00131945.fit
NOTE: Setting QSI Camera to faster download mode.
NOTE: Guider Tracking.
NOTE: Statistics:
Filter: Clear
Image Scale: 1.306 AS/Pixel
Image FWHM: 5.88 AS
Average Pixel value: 17620 ADU
Position Angle: 90 degrees
Focuser Position: 5285
Temperature: 8.8
Image Altitude: 44.12

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Image Aziumth:      301.35
Image Center (J2k): RA: 13h 29m 55.6s  Dec: +47° 11' 53.5"
Image Center (JNow): RA: 13h 30m 42.5s  Dec: +47° 06' 23.6"
-----
NOTE: IMAGE 69 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[03:59:24] Imager: 240s exposure through Red filter.
[04:03:46] Image completed: SVQ-QSI_M_51_Red_Light_00131946.fit
NOTE: Setting QSI Camera to faster download mode.
NOTE: Guider Tracking.
NOTE: Statistics:
Filter:              Red
Image Scale:         1.306 AS/Pixel
Image FWHM:          4.95 AS
Average Pixel Value: 8786 ADU
Position Angle:      90 degrees
Focuser Position:    5282
Temperature:         8.8
Image Altitude:      43.37
Image Aziumth:       301.64
Image Center (J2k):  RA: 13h 29m 55.6s  Dec: +47° 11' 53.7"
Image Center (JNow): RA: 13h 30m 42.5s  Dec: +47° 06' 23.8"
-----
NOTE: IMAGE 70 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[04:03:59] Imager: 240s exposure through Green filter.
[04:08:21] Image completed: SVQ-QSI_M_51_Green_Light_00131947.fit
NOTE: Setting QSI Camera to faster download mode.
NOTE: Guider Tracking.
NOTE: Statistics:
Filter:              Green
Image Scale:         1.306 AS/Pixel
Image FWHM:          5.91 AS
Average Pixel Value: 8540 ADU
Position Angle:      90 degrees
Focuser Position:    5285
Temperature:         8.8
Image Altitude:      42.62
Image Aziumth:       301.94
Image Center (J2k):  RA: 13h 29m 55.5s  Dec: +47° 11' 53.7"
Image Center (JNow): RA: 13h 30m 42.4s  Dec: +47° 06' 23.8"
-----
NOTE: IMAGE 71 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[04:08:34] Imager: 240s exposure through Blue filter.
[04:12:57] Image completed: SVQ-QSI_M_51_Blue_Light_00131948.fit
NOTE: Setting QSI Camera to faster download mode.
NOTE: Guider Tracking.
NOTE: Statistics:
Filter:              Blue
Image Scale:         1.307 AS/Pixel
Image FWHM:          5.85 AS
Average Pixel Value: 6156 ADU
Position Angle:      90 degrees
Focuser Position:    5295
Temperature:         8.8
Image Altitude:      41.87
Image Aziumth:       302.25
Image Center (J2k):  RA: 13h 29m 55.5s  Dec: +47° 11' 54.9"
Image Center (JNow): RA: 13h 30m 42.4s  Dec: +47° 06' 25.0"
NOTE: Guiding Stopped.
-----
[04:13:13] Reported temperature is: 8.7
NOTE: Touching-up Focus.

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[04:14:59] @Focus2 success. Position = 5239
[04:14:59] Slew to m51 starting.
NOTE: Slew in progress.
[04:15:14] Arrived at m51
NOTE: Mount currently at: 303.7 az., 40.47 alt.
[04:15:15] Attempting precise positioning with CLS.
[04:15:54] CLS to m51 success (2.613 AS/pixel).
[04:15:55] Reported temperature is: 8.8
[04:15:55] Calculating dither distance.
NOTE: Imager image scale is 1.31 AS/Pixel.
[04:16:09] Dithered: 4.5 AS (N), 8.3 AS (W)
[04:16:18] Guider: 5s exposure
[04:16:30] Guider Image completed: LSX2_M_51_Light_00334092.fit
[04:16:30] Selected guide star coordinates: 527.88, 458.45
NOTE: Measuring AG exposure.
NOTE: Exposure 1 of 3 brightness: 1.0
NOTE: Exposure 2 of 3 brightness: 1.0
NOTE: Exposure 3 of 3 brightness: 1.0
NOTE: Average brightness: 1.0
NOTE: Star too bright.
NOTE: Exposure: 2.5 Brightness: 0.99
NOTE: Exposure: 1.25 Brightness: 0.57
NOTE: Recommend AG exposure of 1.5 and a delay of 3.5.
[04:17:06] Autoguiding started.
[04:17:07] Guider settle limit set to 0.41 guider pixels.
[04:17:08] Guider off target. (0.59, 0.09) (1 of 30)
[04:17:15] Guider off target. (0.84, 0.29) (2 of 30)
[04:17:22] Guider off target. (-0.75, 0.41) (3 of 30)
[04:17:29] Guider ON target. (-0.11, 0.01) (1 of 5)
[04:17:36] Guider ON target. (-0.17, -0.09) (2 of 5)
[04:17:43] Guider ON target. (0.3, 0.05) (3 of 5)
[04:17:50] Guider ON target. (0.17, 0.15) (4 of 5)
[04:17:57] Guider ON target. (-0.09, 0.03) (5 of 5)
[04:18:03] Continuing.
-----
NOTE: Starting image SET 18 of 20.
-----
NOTE: IMAGE 72 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[04:18:06] Imager: 240s exposure through Clear filter.
[04:22:25] Image completed: SVQ-QSI_M_51_Clear_Light_00131988.fit
NOTE: Setting QSI Camera to faster download mode.
NOTE: Guider Tracking.
NOTE: Statistics:
Filter: Clear
Image Scale: 1.307 AS/Pixel
Image FWHM: 4.99 AS
Average Pixel value: 19066 ADU
Position Angle: 90 degrees
Focuser Position: 5239
Temperature: 8.6
Image Altitude: 40.31
Image Aziumth: 302.92
Image Center (J2k): RA: 13h 29m 52.0s Dec: +47° 11' 45.4"
Image Center (JNow): RA: 13h 30m 38.9s Dec: +47° 06' 15.5"
-----
NOTE: IMAGE 73 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[04:22:41] Imager: 240s exposure through Red filter.
[04:27:03] Image completed: SVQ-QSI_M_51_Red_Light_00131989.fit
NOTE: Setting QSI Camera to faster download mode.
NOTE: Guider Tracking.
NOTE: Statistics:
Filter: Red

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Image Scale: 1.307 AS/Pixel
Image FWHM: 4.77 AS
Average Pixel Value: 9501 ADU
Position Angle: 90 degrees
Focuser Position: 5236
Temperature: 8.6
Image Altitude: 39.57
Image Aziumth: 303.26
Image Center (J2k): RA: 13h 29m 52.0s Dec: +47° 11' 46.4"
Image Center (JNow): RA: 13h 30m 38.9s Dec: +47° 06' 16.5"

NOTE: IMAGE 74 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[04:27:17] Imager: 240s exposure through Green filter.
[04:31:39] Image completed: SVQ-QSI_M_51_Green_Light_00131990.fit
NOTE: Setting QSI Camera to faster download mode.
NOTE: Guider Tracking.
NOTE: Statistics:
Filter: Green
Image Scale: 1.307 AS/Pixel
Image FWHM: 4.85 AS
Average Pixel Value: 9265 ADU
Position Angle: 90 degrees
Focuser Position: 5239
Temperature: 8.6
Image Altitude: 38.83
Image Aziumth: 303.6
Image Center (J2k): RA: 13h 29m 52.0s Dec: +47° 11' 46.4"
Image Center (JNow): RA: 13h 30m 38.9s Dec: +47° 06' 16.4"

NOTE: IMAGE 75 OF 83.
NOTE: Setting QSI Camera to high quality mode.
[04:31:53] Imager: 240s exposure through Blue filter.
[04:36:16] Image completed: SVQ-QSI_M_51_Blue_Light_00131991.fit
NOTE: Setting QSI Camera to faster download mode.
NOTE: Guider Tracking.
NOTE: Statistics:
Filter: Blue
Image Scale: 1.307 AS/Pixel
Image FWHM: 5.6 AS
Average Pixel Value: 6799 ADU
Position Angle: 90 degrees
Focuser Position: 5249
Temperature: 8.5
Image Altitude: 38.1
Image Aziumth: 303.94
Image Center (J2k): RA: 13h 29m 52.0s Dec: +47° 11' 47.4"
Image Center (JNow): RA: 13h 30m 38.9s Dec: +47° 06' 17.4"

NOTE: Guiding Stopped.

[04:36:32] Good morning.
[04:36:32] Ending imaging run.
NOTE: Pointing mount to the north.
[04:36:34] Slew to kochab starting.
NOTE: Slew in progress.
[04:36:49] Arrived at kochab
NOTE: Mount currently at: 341.38 az., 47.0 alt.
[04:36:58] Paramount stopped in set park position.
[04:36:58] Resetting camera defaults.
[04:37:04] System Parked.